FOUNDRY TRADE JOURNAL

EST. 1902

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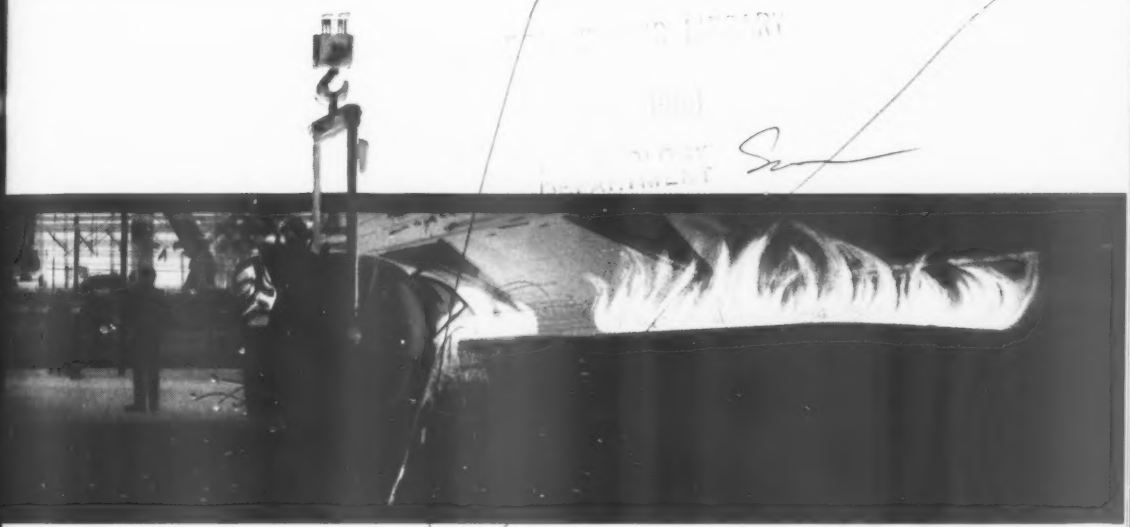


Sterling boxes stay on the job!

Modern foundry practice calls for boxes able to withstand terrific stress and strain. Sterling boxes can be made to any degree of strength and do not of course crack or break like cast iron. Moreover they can be machined to fine limits on the outside for working against stops.

Long life in service, accuracy and assured interchangeability make Sterling the foundryman's first choice.

Sterling
MOULDING BOXES

ING FOUNDRY SPECIALTIES LIMITED
BEDFORD • ENGLAND

FOCUS ON 'FULBOND'

No 2 Bond Development

FULBOND combines rapid bond development and high initial strength enabling moulding sands to be prepared quickly and economically. In addition, the use of FULBOND gives the technical advantages of increased flexibility, wider control and a much more resilient sand.

Where Milling Time Can Be Varied

When a sand mix is milled the strength increases rapidly at first then more gradually until finally no further increase in strength will be obtained. Additions of FULBOND will ensure that optimum bond strength is developed in the shortest possible time. This will eliminate any undeveloped clay in the sand avoiding the bad effects of excess clay and also increasing the output of milled sand to the maximum possible.

Where Milling Time Is Fixed

In mechanised foundries using continuous mills or where, due to the demand for sand, milling time is limited, only a fixed short time can be given. Undeveloped clay will therefore be present, this being wasteful and requiring extra moisture which reduces permeability. FULBOND will keep the content of undeveloped clay to a minimum.

Advantages can also be obtained by using FULBOND in unmilled sands prepared on the foundry floor.

For a copy of this Brochure please write to:

THE FULLERS' EARTH UNION LIMITED

Patteson Court, Nutfield Road, Redhill, Surrey

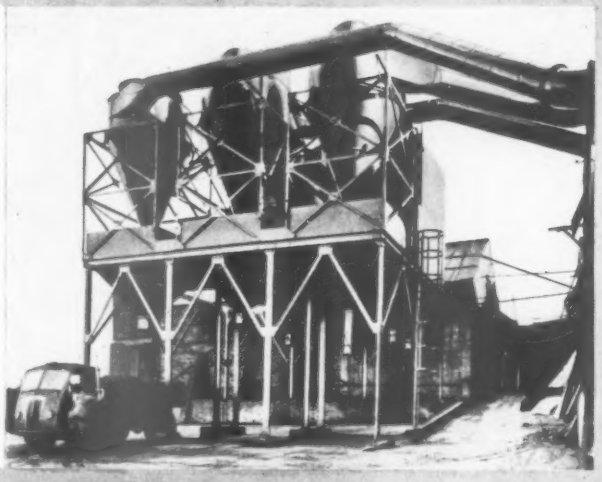
A member of The Laporte Group

CMF57

Keith Blackman for Dust Collection

True economy in DUST EXHAUST and COLLECTION problems demands consideration of

CAPITAL EXPENDITURE **AND** OPERATING COSTS **AND** MAINTENANCE CHARGES . . .



. . . It pays to plan with Keith Blackman who do not minimise the importance of any of these factors, and who have over 76 years' experience in designing to specific requirements.

'Tornado' equipment includes . . 'P' TYPE FANS · DUST EXHAUSTING & COLLECTING UNITS · WET TYPE COLLECTORS FABRIC TYPE DUST COLLECTORS · CENTRIFUGAL SETTLERS DUST SEPARATOR FANS · *TUBULAR HIGH EFFICIENCY COLLECTORS · *ELECTROSTATIC PRECIPITATORS

* *in collaboration with Prat Daniels (Stroud) Ltd*

Applications include the exhausting and collection of FOUNDRY DUST · GRINDING & POLISHING DUST · MINERAL AND CHEMICAL DUST · DUSTS FROM MANUFACTURING PROCESSES · WOOD REFUSE · BOILER GRIT

Settle your dust once and for all—consult

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Birmingham · Bristol · Glasgow · Leeds · Leicester · London WC1 · Manchester · Newcastle-on-Tyne

TA 2177/961

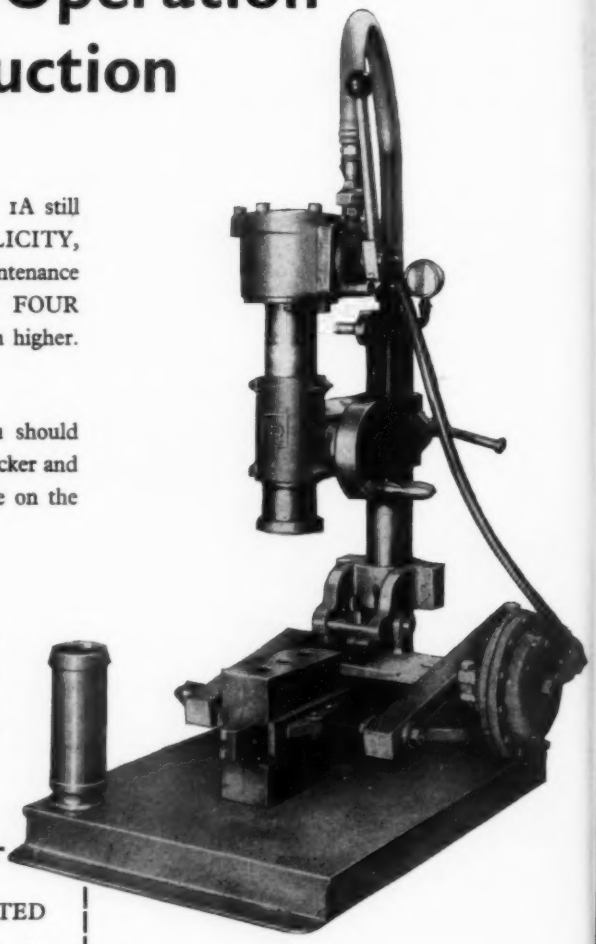
The *NEW* Redford No. 1A

Single Lever Operation
Higher Production

The New Single Lever Redford No. 1A still retains its STRENGTH and SIMPLICITY, but reduces operational time, maintenance costs and labour fatigue. With FOUR operations in ONE production is even higher.

If you make cores up to 2 lbs. you should use a Redford. It will make them quicker and cheaper than any comparable machine on the world market today.

It has great adaptiveness and is used widely co-operating the CO_2 process and the design provides rapid action to all adjustable parts, including the pneumatic clamps.



To BRITISH RONCERAY LIMITED

Please send me further details of the Redford Core Blower/Redford Pneumatic Clamp without obligation.

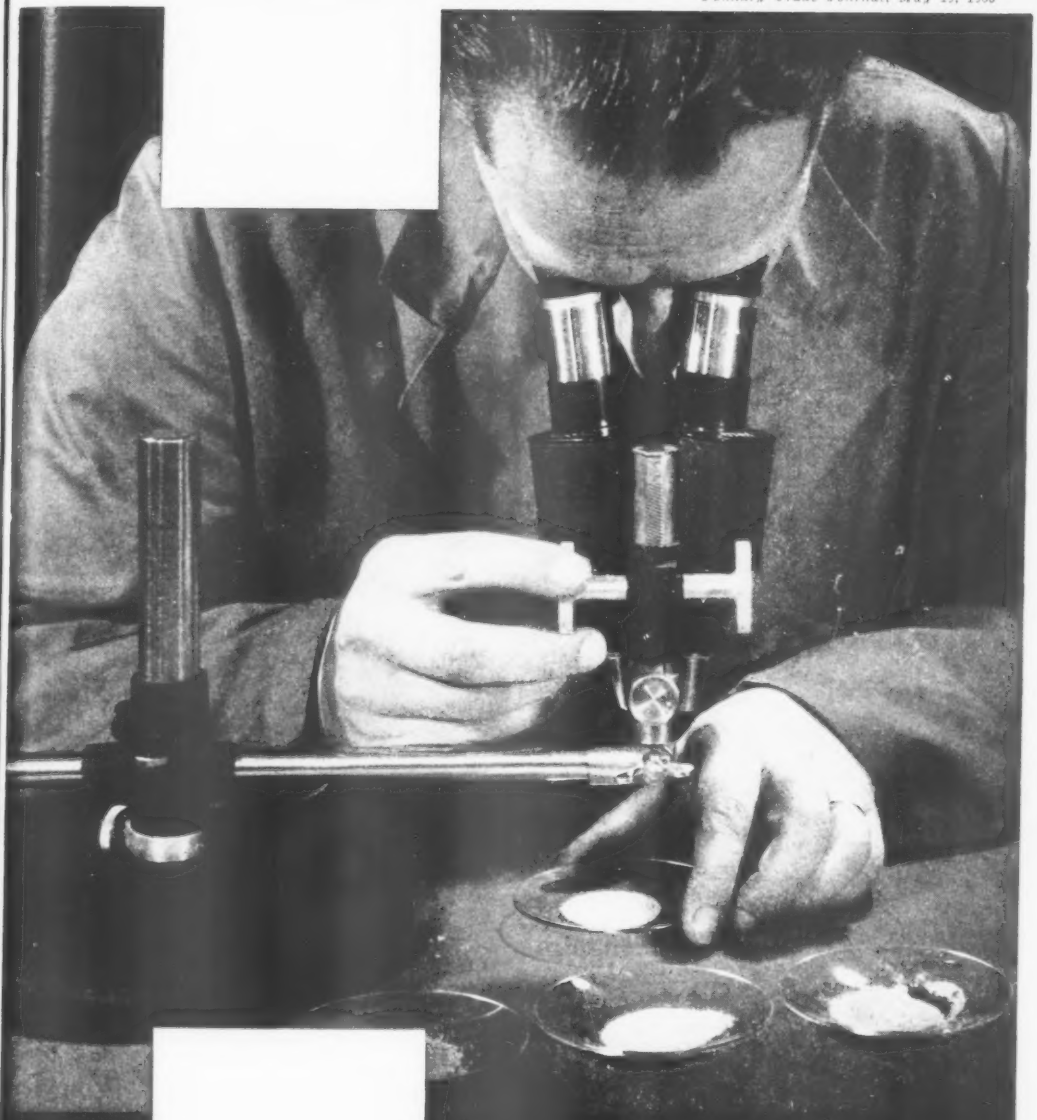
Name ....

... .

Just attach to one of your letter-headings and post to-day to:—

BRITISH RONCERAY LIMITED

14, WOLSELEY ROAD, SHEFFIELD 8



Routine checking of moulding and core sand properties is essential and guarantees improved surface finish of castings, fewer rejects and economical use of sands. The production of quality castings begins with sand testing. In many countries of the world preference is given to

+GF+

Sand Testing Equipment.

Easy handling - reliable test results - pleasing appearance.

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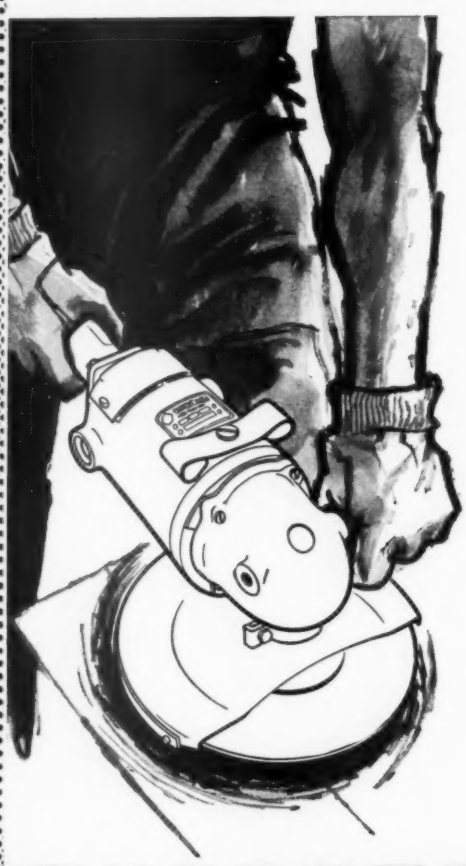
George Fischer Limited, Schaffhausen, Switzerland

Telephone: (053) 5 60 31/5 70 31 Telegrams: Geofischer

Black & Decker

A Grinder with Guts



For years W. Flanagan & Son of Liverpool searched for a portable grinder capable of standing up to continuous heavy duty work in their sheet metal shop.

Black & Decker provided the complete answer with their new Heavy Duty Angle Grinder. Here, at last, is "A grinder with guts" taking every heavy duty grinding operation in its stride. Long after former machines would have broken down, Black & Decker Grinders are still on the job. Service costs are slashed to a minimum, needless production delays eliminated.

Flanagan's say "All future orders for Angle Grinders, of which we are exceptionally large users, will be forwarded to you without hesitation".

12 MONTHS FREE SERVICE FROM DATE OF PURCHASE

Black & Decker's confidence in their new Angle Grinder is backed-up by this positive guarantee of quality and performance. Nc other electric tool manufacturer can match this unique offer.

DEPRESSED CENTRE DISCS. Speed weld dressing —speed edge preparation for welding—speed grinding off flame cut edges.

CUT OFF WHEELS. For removing casting risers —cutting off angle iron, bolts, steel rods, etc.

Attachments also available for wire brushing, sanding, planing.

POST NOW FOR FULL INFORMATION OR 14 DAYS FREE TRIAL

Please send more information on your Angle Grinders ☐

Please arrange a 14 days free trial without obligation ☐

(Tick where necessary)

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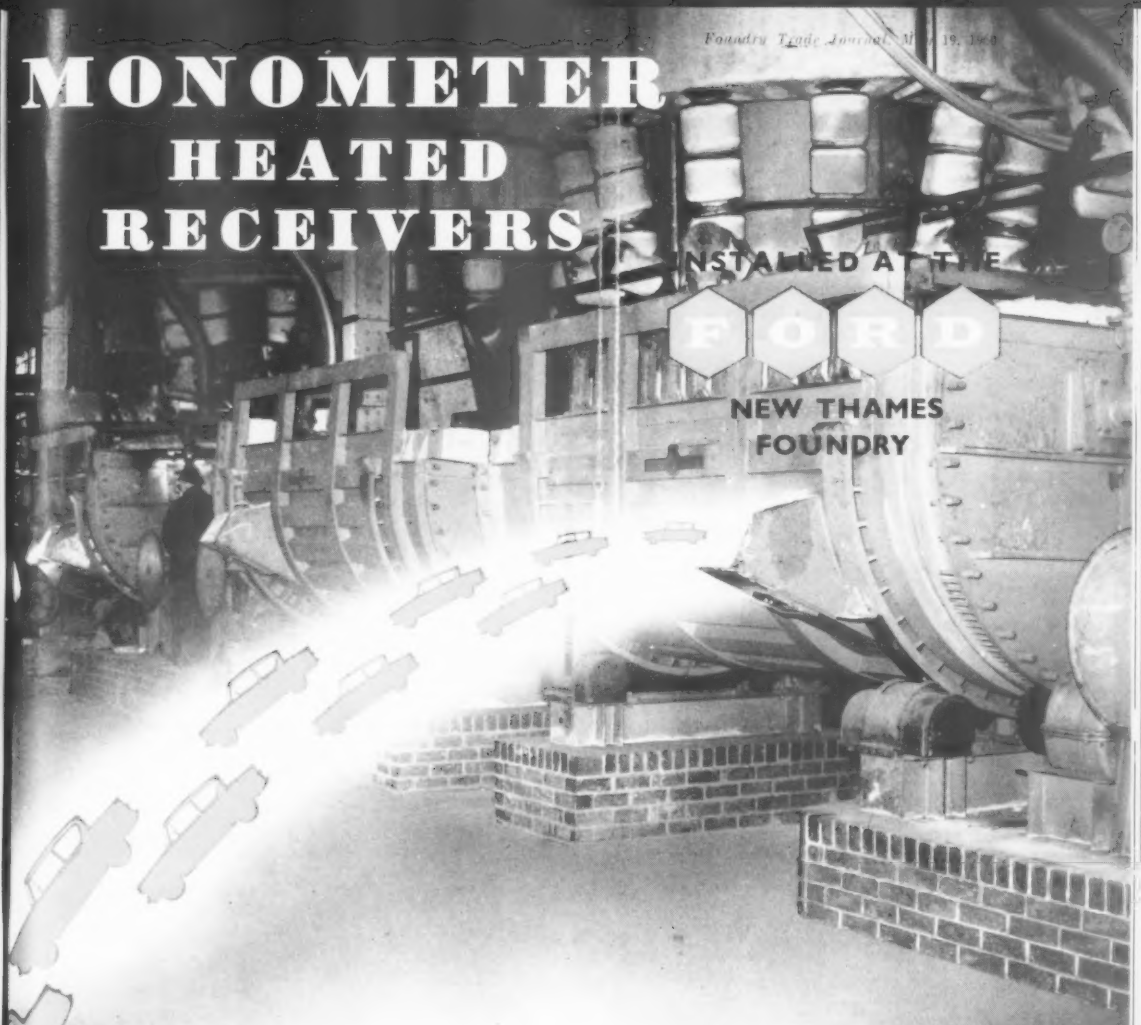

Installation of four 8-Ton Hot-metal Receivers supplying molten iron to the casting bay at Ford's new Thames Foundry. Castings for the **NEW FORD Anglia** are produced from metal at temperatures as tapped from the cupolas.

Receivers may be fired by oil or gas and are available in a wide range of capacities, with motorised or manually-operated tilting.

MONOMETER MANUFACTURING CO. LTD.,
SAVOY HOUSE, 115-116 STRAND, W.C.2. Tel: TEMPLE BAR 9025

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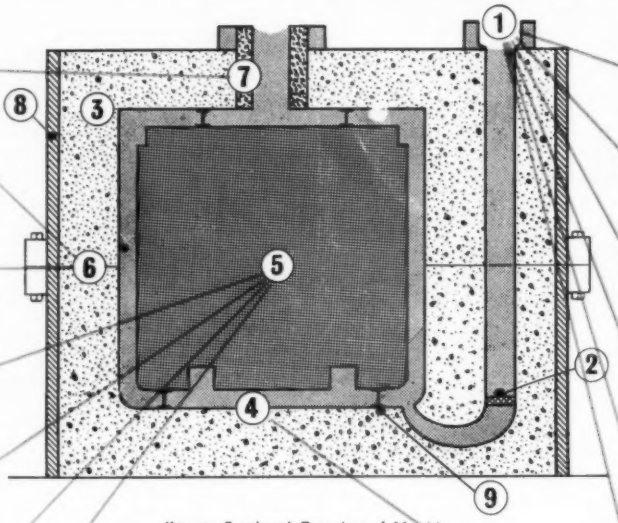

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Key to Sectional Drawing of Mould

		Send for booklet No.
1	Metallurgical Control use of Fluxes.	3
2	Clean Metal by using Ceramic Strainer Cores and Discs.	4
3	Coal Dust additional to Facing and Backing Sand.	1
4	Silverskin Blackings, Plumbago and Mould Dressings.	1
5	Cores using Crulin and Crudol Core Binders (Oil Bonded, Air Setting Cereal or CO.2 Binders).	2
6	Moulds Parted with Beecro Silica Free Parting Powder or Beecrol Parting Liquid.	1
7	Casting Feeding with Alsica Exothermic Feeder Heads.	4
8	Moulding Boxes supplied by B.F.U.	5
9	Chaplets, Studs, etc.	

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THE FOUNDRY SPECIALISTS

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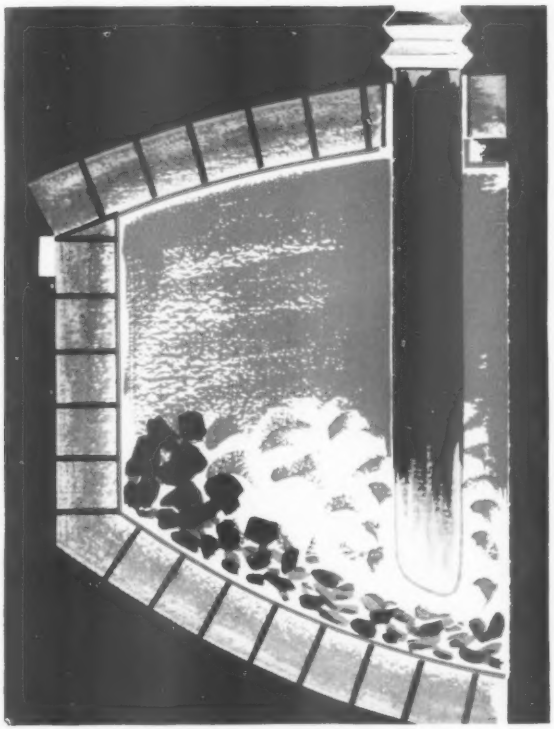
Telephone: 4157-8 Telegrams: "RETORT"



why ACHESON TRADE MARK graphite electrodes

Give You Dependable Service!

"Acheson" Graphite Electrodes are manufactured from specially selected high grade raw materials which are carefully processed at all stages of manufacture under controlled conditions to give a final electrode for your arc furnaces with these properties at their optimum—

LOW RESISTANCE

HIGH MECHANICAL STRENGTH AT OPERATING TEMPERATURES

EXCEPTIONAL THERMAL SHOCK RESISTANCE

"Acheson" Graphite Electrodes are made in the United Kingdom only by

BRITISH ACHESON ELECTRODES LIMITED of SHEFFIELD.

ACHESON
TRADE MARK

GRAPHITE ELECTRODES

The term ACHESON is a registered trade mark

DARTMOUTH AUTO CASTINGS LTD

produce 120 every hour

ON BQ AUTOMATIC MACHINES

Even at these speeds each mould must be perfect and ready to produce a casting with finish and dimensional accuracy up to the standards for which "DARCAST" have become famous.

- ✓ All pneumatic, no electronics
- ✓ Press one button to make a mould.
- ✓ Manual operation whenever required for "pilot" castings etc.
- ✓ Foolproof automatic controller can be varied to suit any required speed or sequence.
- ✓ Shockless jolt, nothing below ground.

Write now for details of these outstanding successful machines or visit our works for a demonstration.

BRITISH MOULDING MACHINE CO. LTD.

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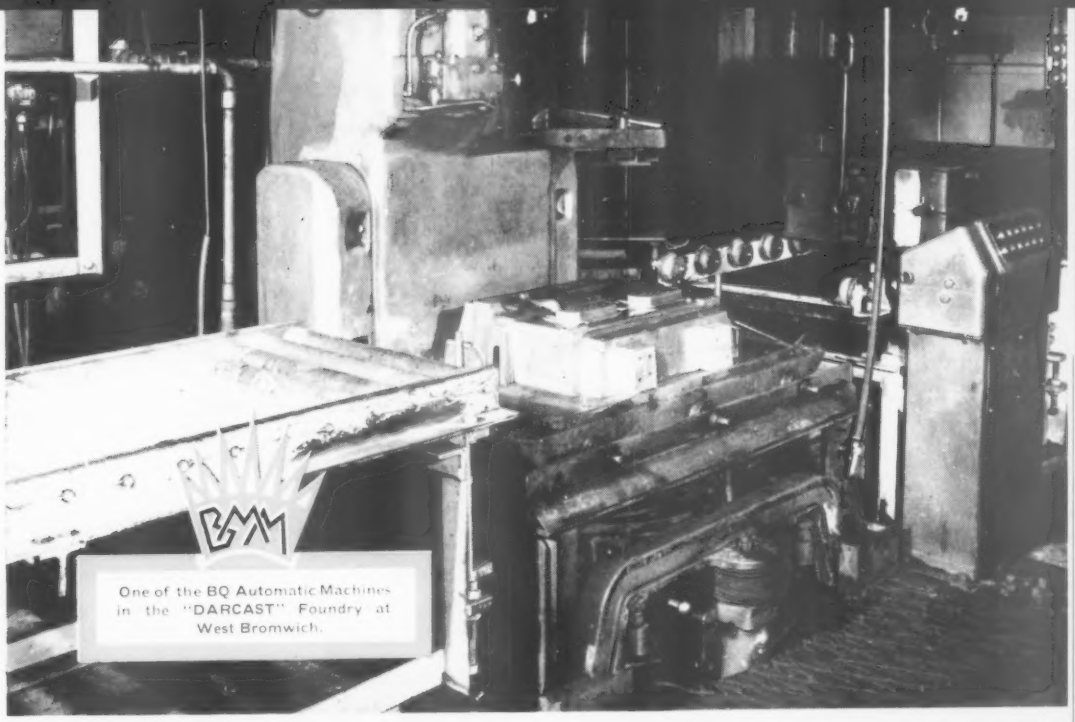
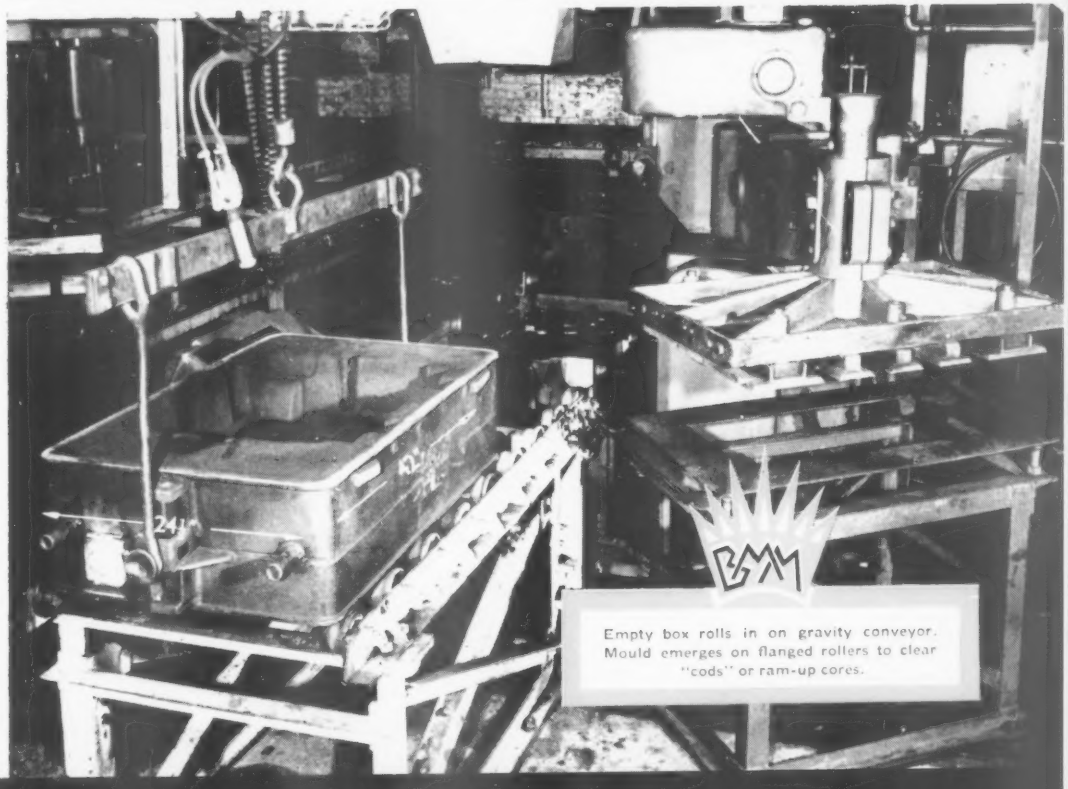


One of the BQ Automatic Machines in the "DARCAST" Foundry at West Bromwich.

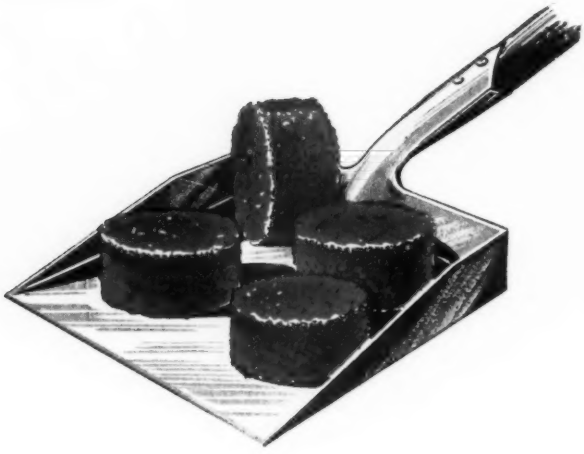


Empty box rolls in on gravity conveyor. Mould emerges on flanged rollers to clear "cods" or ram-up cores.

WESTON WORKS - FAVERSHAM - KENT

Telegrams: EASIRAM, FAVERSHAM

LEADERS IN THE FIELD



...and still in the forefront

UNION CARBIDE, leaders in the manufacture of alloy additive briquettes, provide the finest technical and advisory service available today.
Backed by years of research and development UNION CARBIDE studies minutely every individual problem, application and contingency to provide the most efficient and economic production of all grades of cast iron.
Prompt delivery and after-sales-service, allied to the consistent high quality and competitive prices of UNION CARBIDE briquettes, are appreciated by foundrymen everywhere as a part of UNION CARBIDE'S service to the metal industry.

UNION CARBIDE
Trade Mark

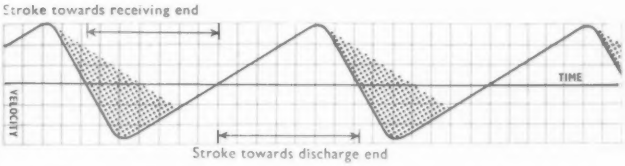
A1

UNION CARBIDE LIMITED
alloys division
103 MOUNT STREET LONDON W1
Telephone: Mayfair 8100

Shaker conveyor discharging scrap on to a similar conveyor. (The photographs reproduced in this advertisement are published by courtesy of Ford Motor Company Limited.)

Sand cores and risers from engine component castings fall on to a shaker conveyor which carries them to a rotary scrap breaker and sand separator.

Shaker conveyor showing type G 20 drive, driven by a 20 h.p. flywheel motor ; this robust drive delivers high peaks of energy.



SHAKER CONVEYING

in a mechanised foundry

The Distington-Goodman shaker conveyor is not a jigger conveyor. Its troughs move in only one plane on ball-bearing rollers and propel material by variations in their rates of acceleration and deceleration (these are shown in the time-velocity curve above: the shaded areas represent the movement of material independent from the movement of the troughs).

Distington-Goodman shaker conveyors have been used for many years for loading and conveying coal and rock. Their robust all-steel construction makes them ideal for handling hot materials in foundries and cement clinker and sinter.

They are easily extended and contracted and can be made self-loading from stock heaps. Lines of troughing can be made to deviate through angles up to 90°. Conveying capacity depends upon several factors but would normally exceed 60 t.p.h. on the level.

DISTINGTON ENGINEERING COMPANY LIMITED

WORKINGTON · CUMBERLAND · ENGLAND

DISTINGTON

DB.21

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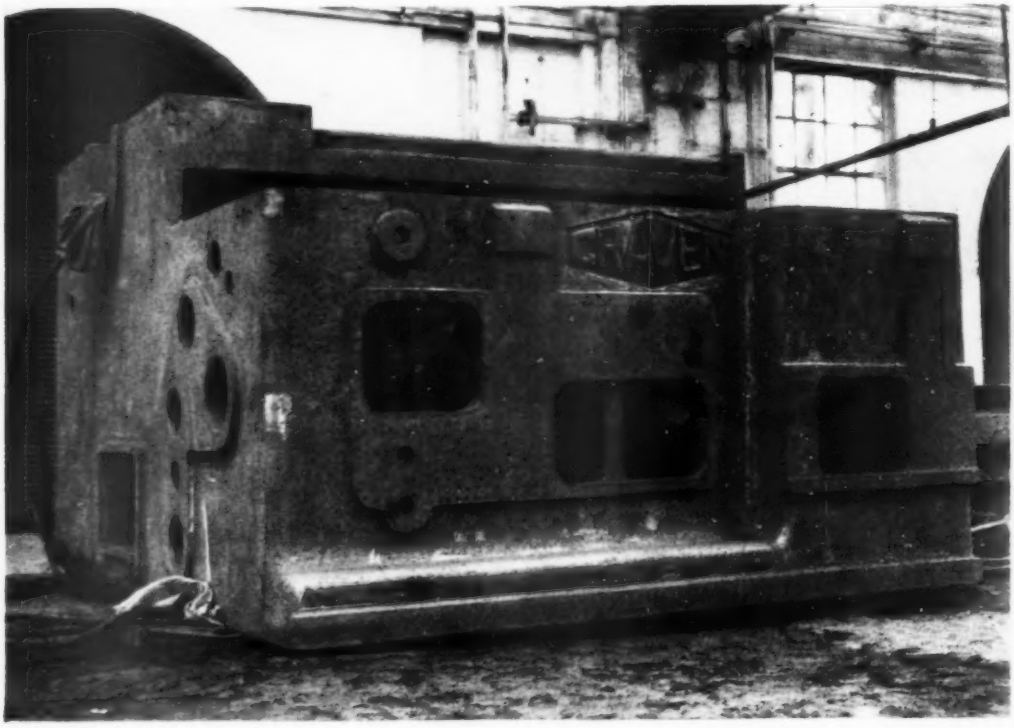
FOR A 1st CLASS STRIP



37 ton HEADSTOCK Casting reproduced
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TERRA FLAKE · COAL DUST · GANISTER AND
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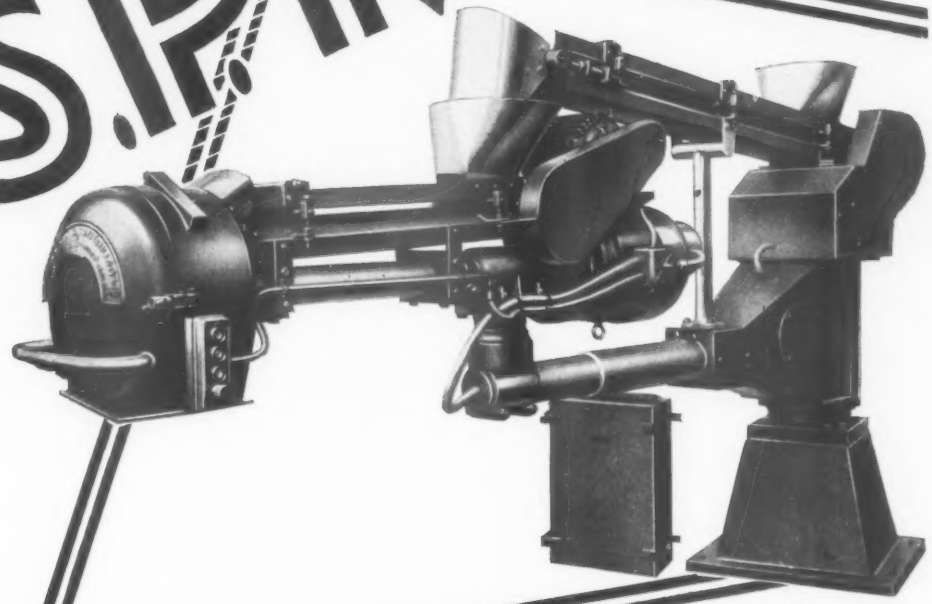

Please send for the fullest details of our **New Sand Projection Machine.** We will gladly arrange to demonstrate this machine to you at our Bletchley Works, and this will not place you under any obligation whatsoever.

FOUNDRY MECHANISATIONS (BAILLOT) LTD.

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Tel.: BLETCHLEY 3354 *Regd. Office:* 39, CROMWELL ROAD, LONDON, S.W.7. *Grams:* "FOUMEC" BLETCHLEY

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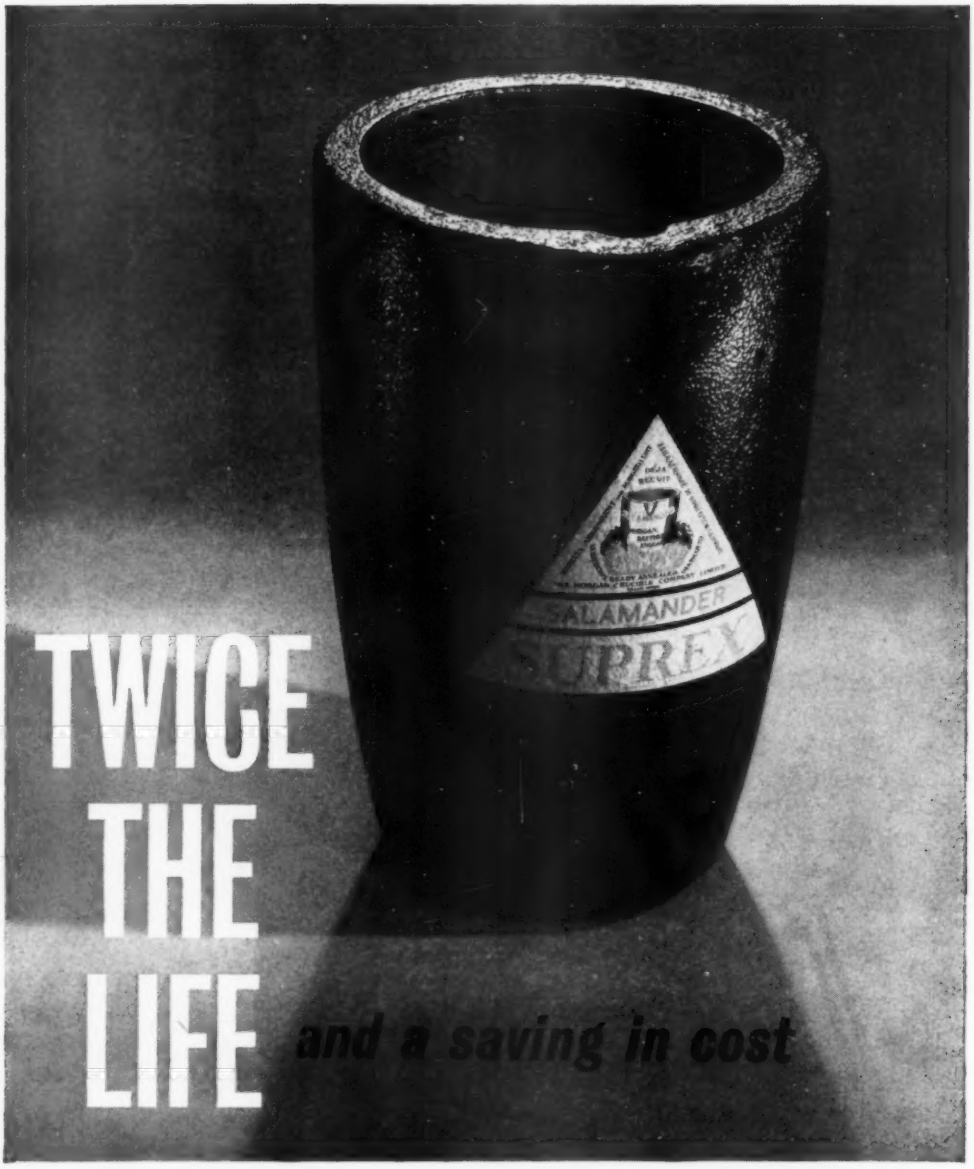

For arduous conditions Salamander SUPREX Crucibles have no equal—practice has proved their exceptional resistance to thermal shock and their maximum resistance to erosive slags. SUPREX often double, sometimes treble, the number of heats; they maintain a constant melting speed, save fuel and ensure minimum costs per ton of metal melted. For long life and a saving in cost, turn to:

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ARE YOUR EFFORTS TO GET THE MAXIMUM BENEFIT FROM YOUR FOUNDRY MECHANIZATION BEING FRUSTRATED BY CONTINUAL MACHINE BREAKDOWNS? ONLY A MACHINE BUILT TO WITHSTAND THE RIGOURS OF FOUNDRY CONDITIONS CAN SAVE YOU THIS FRUSTRATION.

ZIMMERMANN MOULDING MACHINES HAVE GAINED AND ARE MAINTAINING A HIGH REPUTATION FOR TROUBLE FREE OPERATION.

TESTIMONIALS TO THIS EFFECT ARE A REGULAR FEATURE OF OUR BUSINESS.

OVER ONE THOUSAND AUTOMATIC MACHINES ARE GIVING TROUBLE FREE SERVICE.

SPEEDS OF UP TO 200 MOULDS PER HOUR ARE BEING ACHIEVED AND THE FULLEST ADVANTAGE IS BEING DERIVED FROM THEM AS A RESULT OF THE LOW INCIDENCE OF BREAKDOWNS.

IF MACHINE MAINTENANCE IS A HEADACHE TO YOU SEE THE ZIMMERMANN RANGE OF MACHINES FOR YOURSELF

(Sole Representatives in the United Kingdom)

METAQUIP **METALS & EQUIPMENT (W'TON) LTD TEL 23581**

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trouble-free bunker discharge

The primitive, inefficient method commonly used for clearing material which sticks in a storage bunker is by applying a sledge hammer to the side of the hopper. This is a form of low frequency, uncontrolled vibration. When vibration is applied at the *correct* frequency, the *correct* amplitude and the *correct* point of application, almost any material can be satisfactorily discharged.

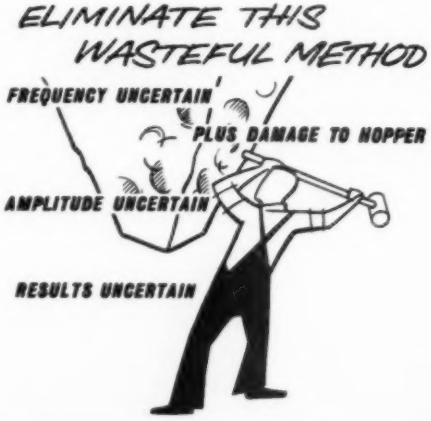
SINEX has the experience with a wide variety of materials and a wide range of hopper designs to recommend how vibration should be applied effectively to solve *your* particular problem.

The three examples illustrated show three different combinations which are typical of many applications, but even these, whilst using the same type of unit, can only be effective if the types of unit themselves are placed in the correct position and have the correct frequencies and amplitudes of vibration, to suit the characteristics of the material to be discharged.

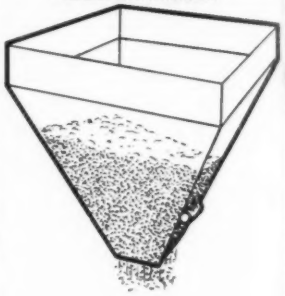
It would pay you, therefore, to make use of our experience and to consult us on your particular problem.

Send for relevant details and information sheet.

These are some of the many materials which we have handled satisfactorily and ensured trouble-free bunker discharge: Pulversized and small coal, iron-ore, coke, lime, flour, grain, grist, foundry sand, soda ash, cullet, sand, gravel, granite chips and all road stone materials.

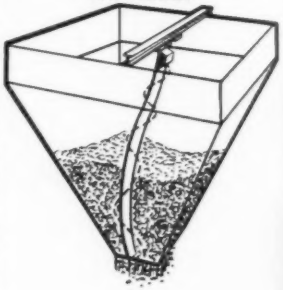


LESS-DIFFICULT



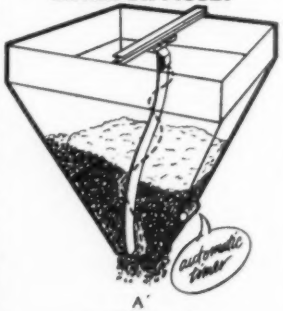
The installation of an external vibrator to a steel hopper.

DIFFICULT



The vibrating reed for application where external vibration is impractical due to structural or other difficulties and if the bunker is made of concrete.

EXTRA-DIFFICULT



A combination of internal and external bunker vibration. Where the external vibrator is timed for 'on and off', the vibration frequency, on slowing down, goes through the natural resonance of the bunker, irrespective of load material contained.

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Bunker clearance Equipment

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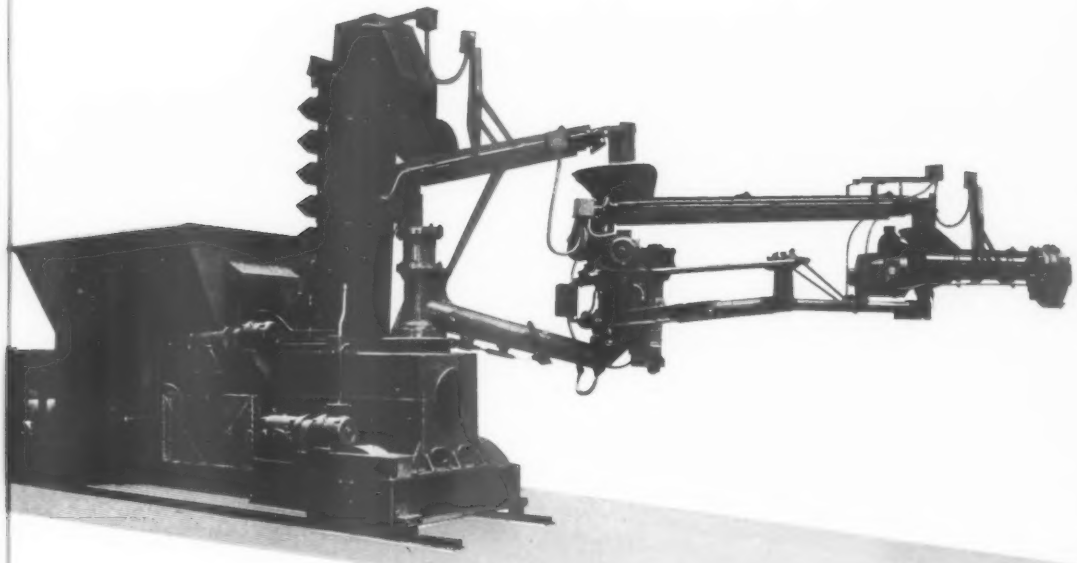

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Two important factors
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Secondly, our technicians will advise you
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for any particular job, to ensure
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Heavy Duty SLINGER

fully automatic design or with co-ordinate control system

sand quantity 55 cbm/h (1770 cu. ft./h) slinging speed up to 60m/sec. (197 ft. sec.)

Stationary or mobile design ● total arm length up to 9·5 m (29 ft.) Slinger motor up to 100 h.p. ● inclinable ramming head ● also suitable for the manufacture of moulds for cast steel.

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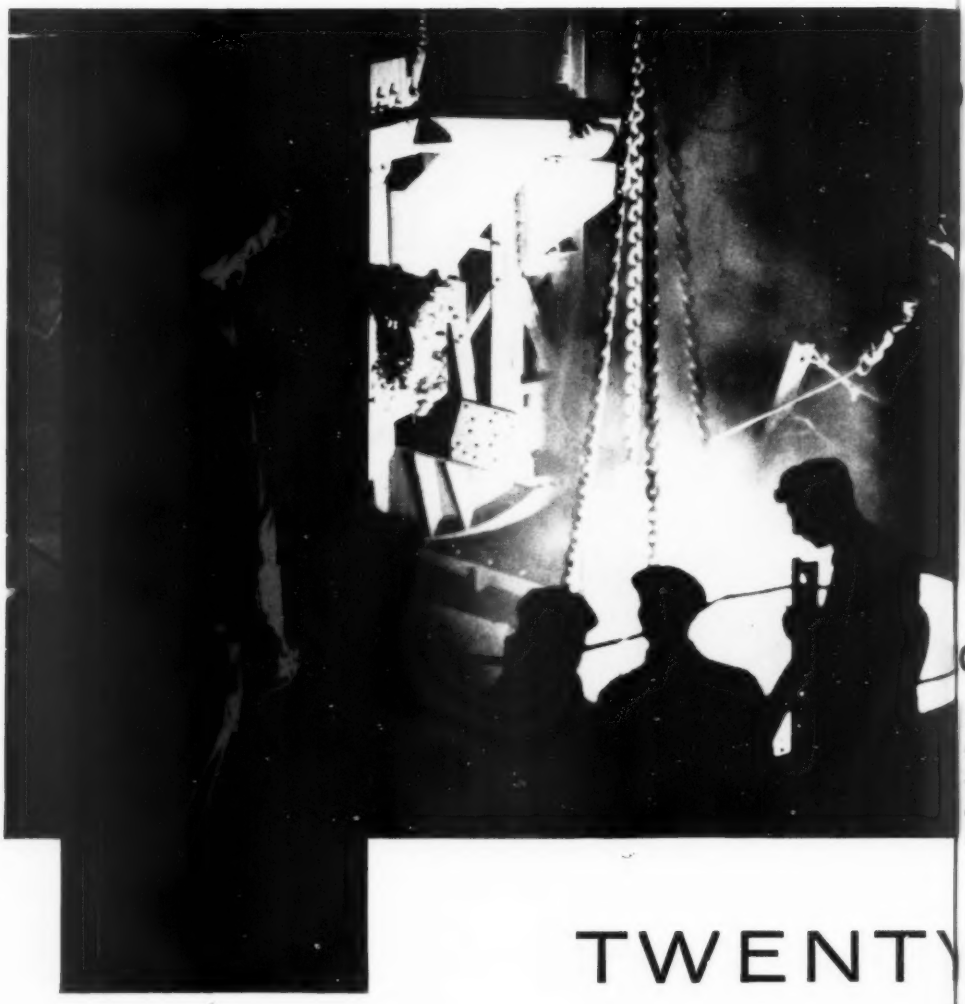

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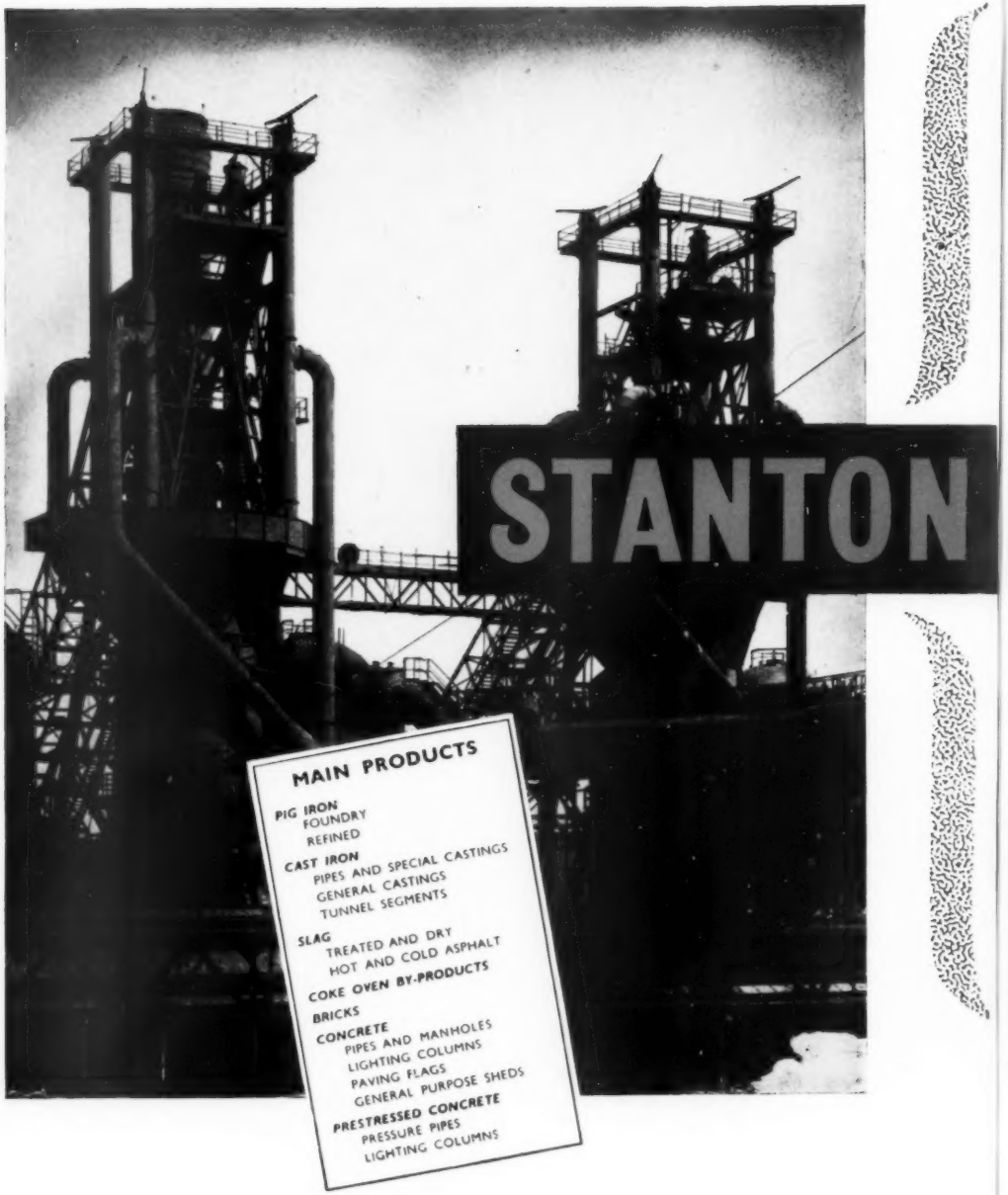

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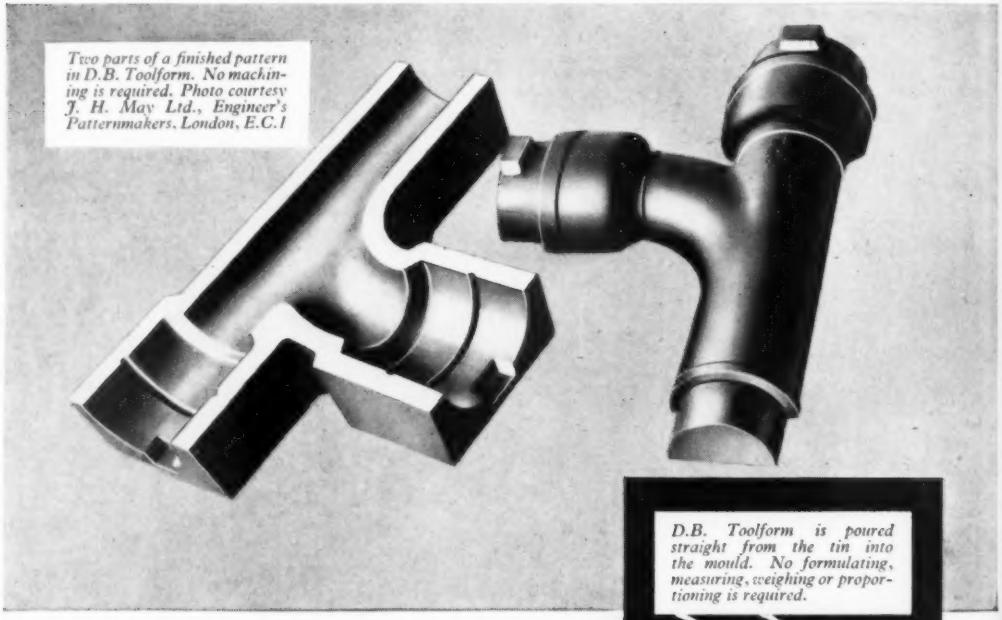

Two parts of a finished pattern in D.B. Toolform. No machining is required. Photo courtesy J. H. May Ltd., Engineer's Patternmakers, London, E.C.1

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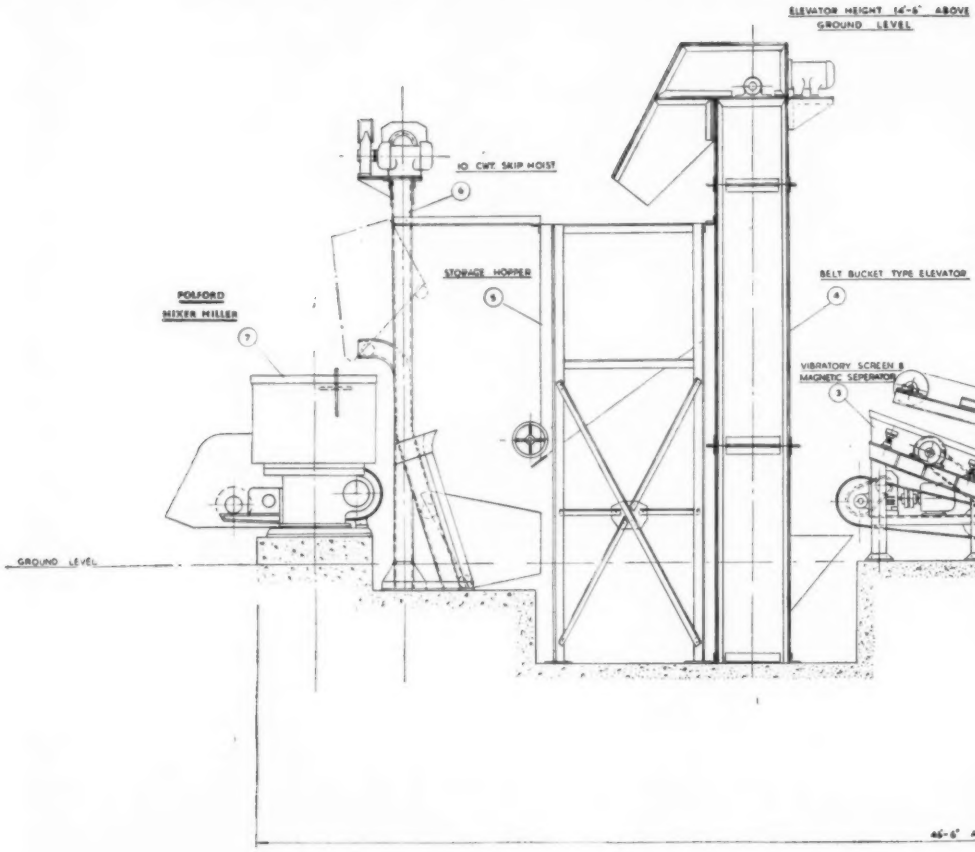

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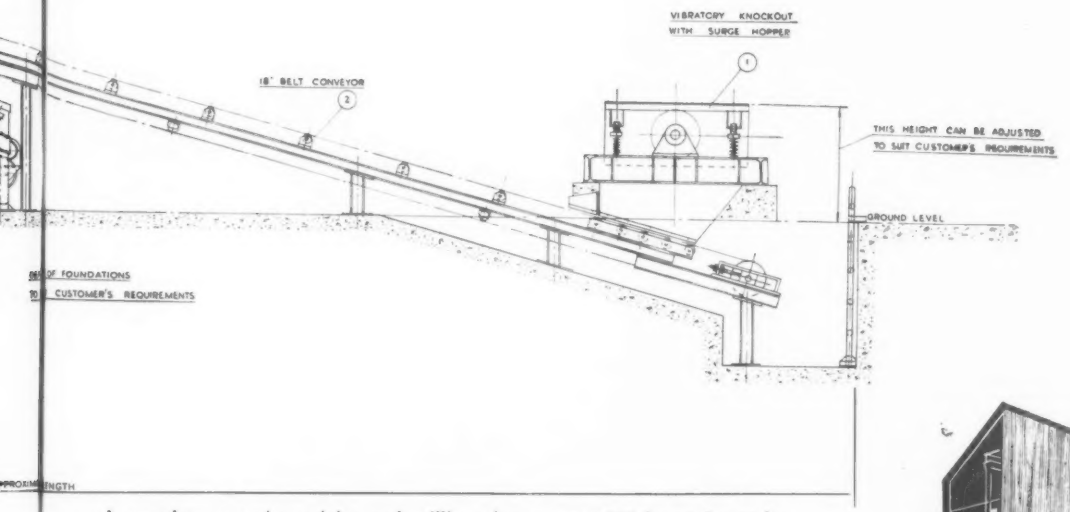

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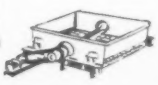

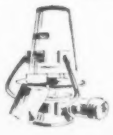
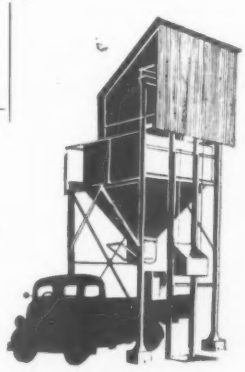

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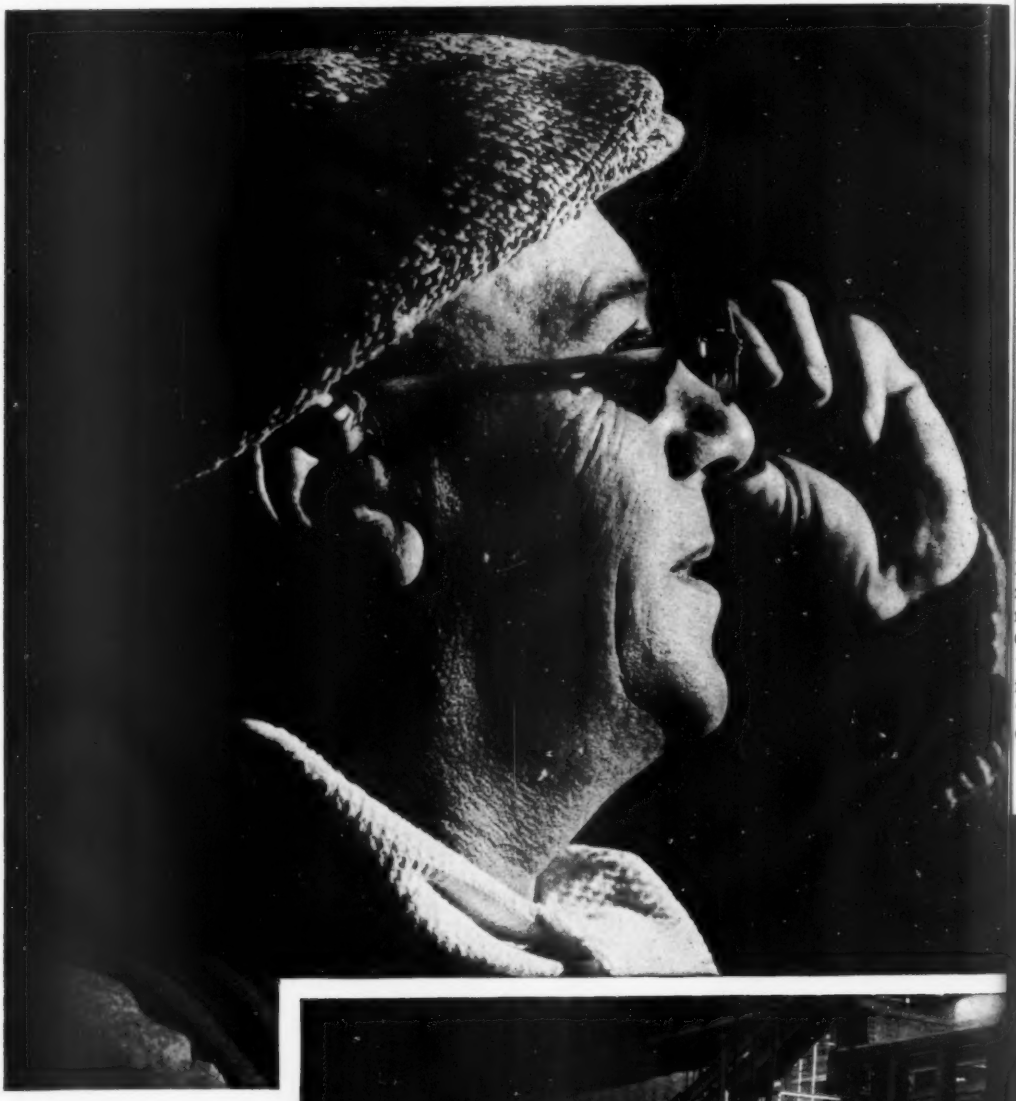

MR. LOMAN WELCH, first hand melter at the Appleby-Frodingham works of United Steel, Scunthorpe, will go to New York to show how he operates the 'Ajax' furnace. This new oxygen-breathing furnace has a record-breaking output 50% above normal, of finest quality steel.

'AJAX' STEEL FURNACE ▶

U.S. to get an eye-opening look at Britain's modern steel industry

NEW YORK in June. That's when Americans will be rolling up in their thousands at the British Exhibition. And there they'll see an eye-opening display of what Britain's steel industry can do.

Britain led the world in creating plentiful low-cost steel. It was an Englishman, Bessemer, who by inventing his "converter" turned steel from a rarity into an everyday necessity.

Another Englishman, Brearley, discovered stainless steel.

But the accent will be on the modern developments that are putting Britain right in the forefront of steelmaking progress.

One of the highlights of the Exhibition will be 'Ajax', a new type of British steel furnace that is giving record outputs, 50% above normal. 'Ajax' furnaces breathe in oxygen and yield top quality steel in prodigious quantities. Up to 5,000 tons per week and more—from a single furnace!

New alloy steels have been developed for use in atomic reactors—including boron steel, which absorbs neutrons. As originally made, boron steel was too brittle to shape: but British steel scientists overcame this difficulty.

Visitors to the Exhibition will learn about some of the superb things made nowadays with British steel, from sports cars to radio telescopes and from precision tools to jet engines. The steel industry will show the vital contribution it is making to Britain's present-day prosperity.

A feature on the steel industry's display in New York forms part of the British Iron and Steel Federation's "Spring Report to the Nation"

The British Iron and Steel Federation, Steel House, Tothill Street, London, S.W.1.

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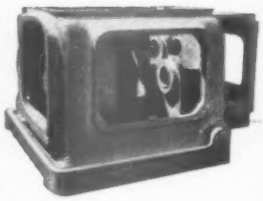

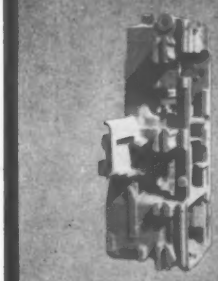

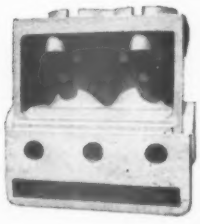

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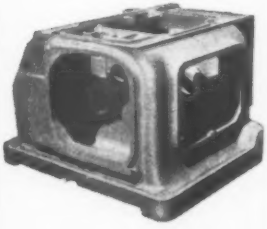

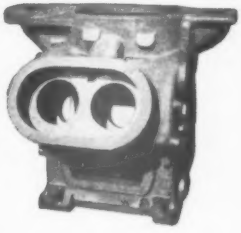

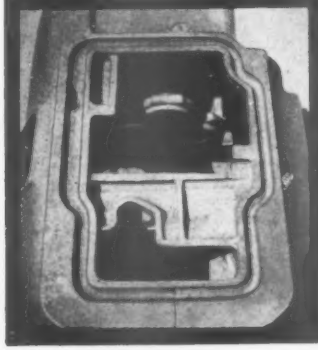

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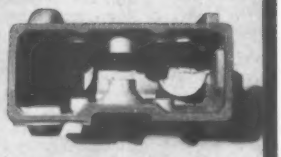

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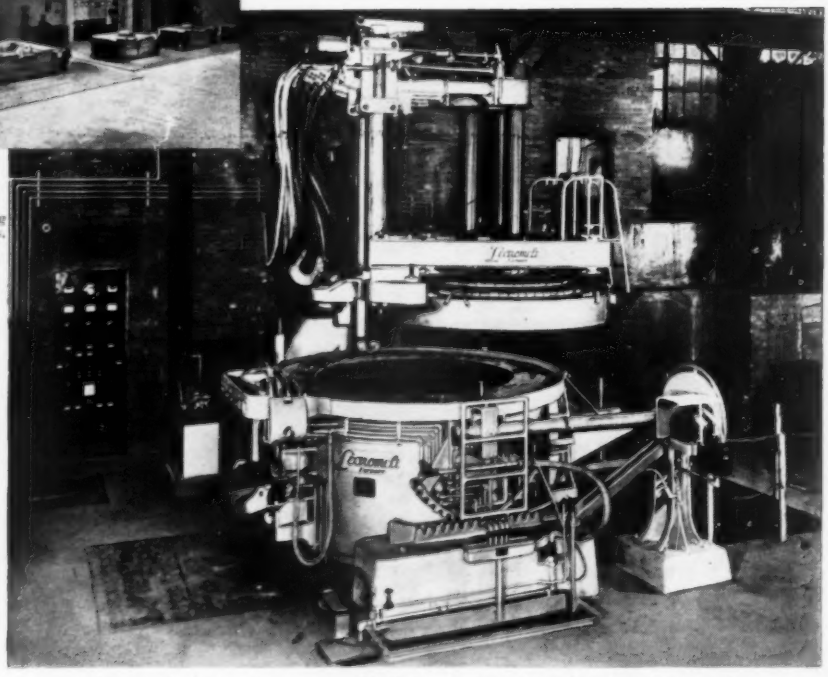
Demag High-frequency induction furnace installation at a steel making plant, incorporating two 1 ton capacity furnaces, two 660 lb. capacity furnaces, and one 110 lb. capacity furnace.



A 3 ton capacity Lectromelt arc furnace of 9' 0" diameter shown with roof swung ready for charging.

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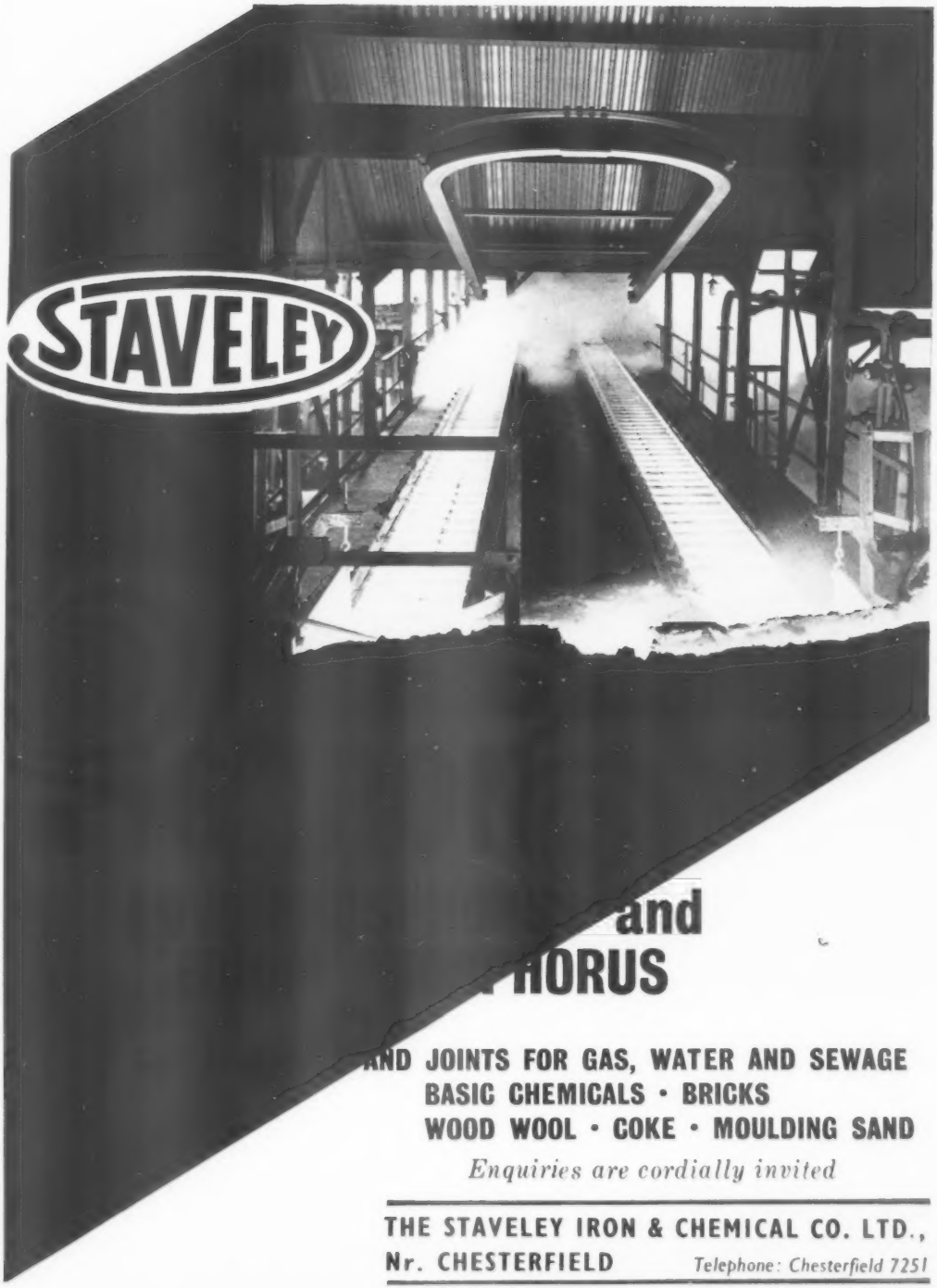

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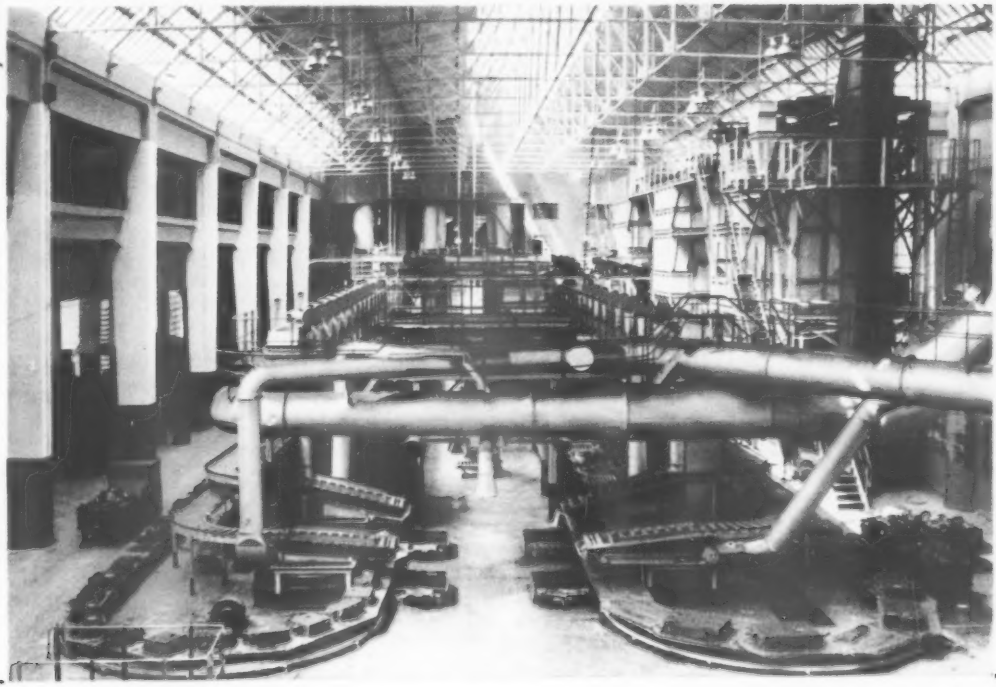

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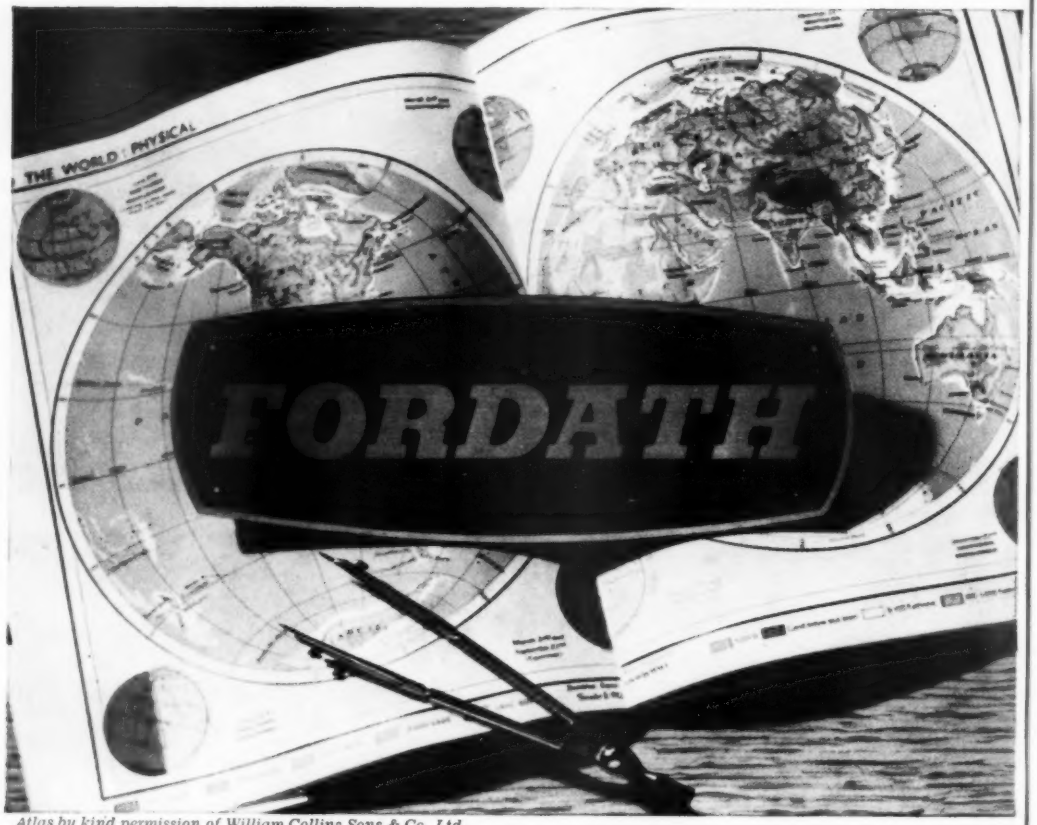

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Assistant Editor: A. R. PARKES, M.I.B.F.
Commercial Editor: P. E. CARDEN.

Advertising Manager:
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District Representatives:
G. P. ELLIOTT (Northern Area) 'phone: Altrincham 1334
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FOUNDRY
TRADE JOURNAL

Vol. 108 May 19, 1960 No. 2267

Business as Usual

When war was declared in 1914, the Government of the day flooded the country with the slogan "Business as Usual," as it deemed that despite hostilities, exports were essential for national survival. Now in 1960, after fourteen years of relative peace, the slogan—so far as foundry recruitment is concerned—has fallen into disrepute, and military requirements are taking precedence. This is adversely affecting foundries serving the exacting requirements of the machine-tool industry—which is generally recognized as being a "key" industry in the export market. A number of machine-tool founders assert, not without reason: (1) that the recruitment of adequately-skilled labour is bordering on the impossible; (2) that to overcome this difficulty, they have trained staff themselves by the institution of expensive apprenticeship schemes, and (3) that the final outcome is that these young men, now highly skilled, are still being drafted for national service.

The situation can result in excessive overtime being worked by the remaining personnel, delay in the delivery of castings, rejection of orders for castings urgently required, and all the associated disadvantages to be associated with labour shortages. The ludicrous situation posed is that on the other hand the various Government departments are doing their utmost to promote apprentice recruitment and training, by exhortation to employers for support and by creating centres designed to take care of the instruction during the first year of the lads' instruction. It is disillusioning and frustrating for employers who foresaw the current skilled-labour needs, and met them by going ahead with training schemes, to find that the very existence of their businesses is being jeopardized by so-called military requirements. Even the technical colleges have been embarrassed by the threatened call-up of their lecturers and demonstrators and only appeal to the highest authorities has prevented the closing down of essential classes.

The business of founding is, as the very word denotes, a basic industry and employers adversely affected by the call-up of properly-trained and efficient workmen, should persevere in efforts to keep these men, by constant appeal to higher and still higher authorities in all the various Ministries—Education, Labour and Board of Trade. We suggest that an appeal, backed by numbers of founders who find themselves in this situation, should be made to add force to individual arguments. This might carry enough weight to break through Ministerial red tape.

Luncheon

BRITISH NON-FERROUS METALS RESEARCH ASSOCIATION

The annual luncheon of the British Non-Ferrous Metals Research Association was held on Wednesday, May 11, at the Savoy Hotel, London, about 350 people attending. Accompanying Mr. F. C. Braby, M.C., D.L. (chairman of Council), at the top table were the Rt. Hon. the Lord Mills, K.B.E. (Paymaster-General), Dr. R. Bennett, V.R.D., M.P. (chairman of the Parliamentary and Scientific Committee), Mr. W. F. Brazener, J.P. (hon. treasurer, vice-chairman of Council, chairman, Finance and General Purposes Committee), Dr. L. B. Pfeil, O.B.E. (vice-chairman of Council, chairman, Research Board), Sir Frank Lee, G.C.M.G., K.C.B. (Joint Permanent Secretary, Treasury), Sir Walter Drummond (chairman of Industrial Grants Committee, Department of Scientific and Industrial Research), Dr. J. Taylor, M.B.E. (member of Council), Professor A. J. Murphy (president, Institution of Metallurgists, member of Council), Sir John G. Lang, G.C.B. (Permanent Secretary, Board of Admiralty), Mr. W. Brining (president, Aluminium Development Association), Mr. A. M. Baer (member of Council), Sir Owen Wansbrough-Jones, K.B.E., C.B. (member of Council), Sir Richard Powell, K.B.E., C.B., C.M.G. (Permanent Secretary, Board of Trade), Sir Maurice Dean, K.C.B., K.C.M.G. (Permanent Under-secretary of State for Air), Mr. D. P. C. Neave (member of Council), the Hon. R. M. Preston, D.S.O. (member of Council), Mr. P. F. Barrett (Deputy High Commissioner for Rhodesia and Nyasaland), Vice-Admiral Sir Norman Dalton, K.C.B., O.B.E. (chief naval engineer officer, Board of Admiralty), Mr. R. L. H. Lancaster (chairman, British Non-Ferrous Smelters' Association, member of Council), Brigadier H. P. Crosland, C.B., C.B.E., M.C., T.D., D.L. (chairman, Zinc Development Association), Dr. J. H. Watson, C.B.E., M.C. (president, Institution of Mining and Metallurgy), Dr. Maurice Cook, C.B.E. (chairman of Council, 1955-59), Sir John A. Carroll, K.B.E. (Deputy Controller, Research and Development, Board of Admiralty), Mr. J. N. V. Duncan (president, British Overseas Mining Association), Dr. R. Cockburn, C.B., C.B.E. (chief scientist, Ministry of Aviation, member of Council), Dr. W. G. Hiscock (member of Council), Mr. J. M. A. Smith (president, Society of Motor Manufacturers & Traders, Limited), Mr. E. J. Vaughan (member of Council), Mr. N. I. Bond-Williams (member of Council), and Mr. C. H. M. Holden (member of Council).

After the Loyal Toast, the Rt. Hon. the Lord Mills proposed the toast of "British Non-Ferrous Metals Research Association" to which Mr. Braby responded. "The Guests" was proposed by Mr. Braby and Dr. R. Bennett replied.

Electrical Power Convention

The British Electrical Power Convention makes its second visit to Bournemouth, for its twelfth annual meeting from May 30 to June 2, under the presidency of the Rt. Hon. Viscount Chandos, P.C., D.S.O., M.C., chairman, Associated Electrical Industries, Limited. The Convention is representative of all the principal organisations, 41 in number, connected with the British electrical industry and is a direct successor of the Incorporated Municipal Electrical Association's Convention, whose 52nd and last meeting was held in Eastbourne in June, 1948.

Programme

This year the theme of the Convention will be "The New Horizon" and the subject will be covered in four papers as follow:—

Tuesday, May 31, 9.30 a.m.: "Electrical Manufacture" by the Hon. H. G. Nelson (managing director, English Electric Company, Limited); 2.45 p.m. "Electricity Supply," by Mr. C. R. King (chairman, Electricity Council). June 1, 9.30 a.m.: "Electrical Export" by Mr. E. V. Small (chairman of the export panel, British Electrical and Allied Manufacturers' Association, and joint managing director, Associated Electrical Industries Export, Limited); 2.45 p.m. "Electricity in the Home," by Mr. T. E. Daniel (chairman, British Electrical Development Association, and chairman, North Western Electricity Board). In the evening at 7 for 7.30 p.m. the annual dinner is to be held with the Marquess of Salisbury, K.G., P.C., F.R.S., as the principal guest. An Electrical Forum has been arranged for Thursday, June 2, commencing at 10.0 a.m. At this Viscount Chandos will be the question master and the panel will consist of four people prominent in the electrical field.

Discussing the Convention at a Press conference in London on Monday of this week, Viscount Chandos mentioned that since the war this country had directly exported goods to the value of £2,800,000,000, and that the last four years' average of £270,000,000 had been exceeded in 1959. These figures did not take into account indirect exports, *i.e.* of equipment included in such items as machine tools. In contrast with most other commodities, the price of electricity has been kept relatively stable. Electricity remained the major means of reducing universal "toil and sweat" and the demand for power had been found to double itself every ten years, both in the more advanced and in the so-called under-developed countries in the world.

Correspondance

CAST CANNON—THE 15th TO 19th CENTURIES

To the Editor of the FOUNDRY TRADE JOURNAL

SIR,—I have just read the article "Cast Cannon—the 15th to 19th Centuries," by P. J. Browne, which appeared in the FOUNDRY TRADE JOURNAL, February 11 issue, and would like to draw your attention to a curious error which occurs throughout the article.

I refer to the reference to "'Deuis' in his Encyclopedie," which occurs on page 164 under the heading "Mould Drying." In fact this is a misprint for "Denis" the christian name of Diderot, who in collaboration with one D'Alembert compiled this first of all encyclopedias. The correct reference should have been "Diderot in his Encyclopedie,"—Yours, etc.

F. L. PEARSON,
Librarian.

Library of Commerce, Science
and Technology,
Central Library, Leeds 1.

Latest Foundry Statistics

Light-alloy Castings: The Ministry of Aviation reports that during February 1,806 tons of aluminium-alloy castings were made from sand moulds. Production of gravity-die castings was 4,754 tons and pressure-die-castings amounted to 2,285 tons. The output of magnesium castings during this month was 166 tons.

Mechanized Foundry in North Wales

Description of Melting and Moulding Procedures adopted by Austin Hopkinson & Company, Limited

Several years ago, Austin Hopkinson & Company, Limited, of Audenshaw, manufacturers of mining equipment, were encouraged by the Development Commission to site their new foundry at Penygroes, Caernarvonshire. This village, which had been for long dependent upon slate quarrying for its prosperity, had suffered the effects of acute unemployment when reduced demand for slate had caused many of the quarries to close. To alleviate unemployment, the Commission sought to introduce new industries into the area, and the result of negotiations was the entirely new works described below.

In September, 1957, a meeting was arranged between representatives of Austin Hopkinson & Company, Limited, and Wales and Monmouthshire Industrial Estates, Limited, who had been requested by the Development Commission to act as agents for the erection of a new factory. Apart from office and cloakroom facilities, ample production space was required, and it had been agreed that the whole scheme should occupy 35,000 sq. ft. The estimates submitted to the Commission for approval provided for a three-bay factory.

Site Investigation

Various sites suggested by the local authorities were investigated. Of those surveyed, the most suitable one lay just south of Penygroes, near the Nantlle Valley, where redundancy amongst local workers had caused severe depression. Some years previously, a pond on the site had been filled in, and though it was not ideal, the site was favoured for the availability of essential services. From site investigations it was determined that the maximum depth of foundations needed to reach solid ground beneath the old pond was between 11 and 12 ft. In October, 1957, working drawings approved by Austin Hopkinson were submitted to the local Council and Planning Authority by Wales and Monmouthshire Industrial Estates, Limited. Tenders were received in January, 1958, and the contract, for completion in 15 months, was awarded to William Cowlin & Son, Limited, of Bristol.

Design of Buildings

With regard to the external appearance of the factory, it was agreed that some consideration should be given to local materials. Accordingly, the lower part of the front wall, which faces roughly northwards at right-angles to the main road (A4085), and one wall of the entrance hall, were built in a green slate from a nearby quarry. These walls, with their rough-hewn texture of greens, browns, reds and yellows, are a handsome feature of the factory's architectural design.

Working Bays

In the factory building three working bays are provided: one is for mould making and cores, one for mould assembly and casting, and the third is a machine shop. A part of the works is equipped as a fabrication section, where welded fabrications and steelwork for the main works are constructed. The bays are each 250 ft. long and 35 ft. wide, and measure 20 ft. to the underside of the roof trusses. The building itself, which adjoins the office block, is of steel frame construction with 11-in. cavity walls. To give the necessary degree of thermal insulation, the asbestos cement roof sheeting is lined internally with ¼-in. asbestos board backed with 1 in. of insulating quilt.

FIG. 1.—*Molten metal from the Birlefco mains-frequency furnaces is here being poured into a special mould, to form the plug of metal required for starting up the furnace from cold on the following day's operation.*

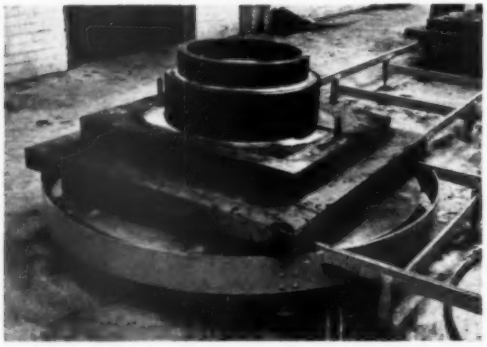


FIG. 2.—*General layout and details of a typical pattern-plate assembly at Austin Hopkinson's new foundry at Penygroes, Caernarvonshire.*

Under the terms of this agreement with Wales & Monmouthshire Industrial Estates, Limited, Austin Hopkinson were responsible for the purchase of all equipment for the buildings, including cranes, melting furnaces, and sand plant. Additionally, all light fittings, power-mains from main switches, and internal wiring were the responsibility of the company. At a cost of £9,000, overhead-travelling cranes of 3-ton capacity are provided in each of the three bays, for handling heavy parts, castings, and ladles of molten metal—the maximum height of lift is 15 ft. 3 in. to the crane rail.

Pouring Bay

With the exception of a gangway on each side and a finished area at each end, the floor of the pouring bay has been left in rough concrete 3 in. below the finished floor-level, so that the main area can be filled with sand for casting purposes. Two Birlefco mains-frequency coreless induction-melting furnaces (see Fig. 1) are installed at the west end of the pouring bay. To enable the necessary structural arrangements to be made during the erection of the factory, drawings were supplied by Birlec-Efco (Melting), Limited.

The £26,000 furnace installation is used for melting iron and steel scrap in the production of castings for mining-equipment components. High-quality grey-iron castings up to 1 ton, and steel castings up to 10 cwt. are produced in the foundry, and can be supplied either as rough castings or finished machined. Each rated at 450 kw., the furnaces have nominal capacities of 30 cwt. They work alternately, and one furnace can be re-lined whilst the other is in operation. Not only does this arrangement permit day and night foundry operation, but it also necessitates only one set of electrical gear. Moulds are stored, cored and closed in the pouring bay, and remain there until they are cast.

Production by CO_2 Process

When planning production methods, local conditions were given chief consideration. Since a large proportion of the labour force was to be recruited locally, most of the employees would have no previous experience of foundry work. Consequently, much thought was devoted to the adoption of methods requiring minimum training and supervision. The services of Guthrie, Adams & Company, of Leeds, were retained as foundry consultants on the entire scheme.

After close consideration, the foundry was planned and equipped for the production of castings moulded solely by the CO_2 process, and about £23,000 was allocated for the complete sand-plant. Sand of suitable grain size and low clay content is mixed with a sodium-silicate solution of appropriate silica/soda ratio and viscosity, and the mixture is then rammed into coreboxes or around patterns in the traditional way. The moulds or cores are then hardened by gassing with carbon-dioxide. Hardening is extremely rapid, and casting may follow immediately afterwards, since no storage is necessary. Arrangements have been made for the supply of solid carbon-dioxide, and four liquefiers have been installed to convert this into gas.

Standardization of Procedures

Though most of the castings made at Penygroes are used by Austin Hopkinson's main works at Audenshaw, near Manchester, the company also produces castings for the open market. Many of these are cast in batches up to 50 off, and can be handled on a semi-repetitive basis. Since all the moulds and cores are made by the CO_2 process, all patterns and moulding equipment have been designed to utilize the process to the full, thus reducing the need for skill to a minimum on every operation. Standardization was also borne in mind when designing the moulding boxes, and deciding patternplate sizes. It was finally agreed to use only three sizes of moulding box, *viz.*, 50 by 44, 44 by 34 and 36 by 30 in. All patterns are made on single-sided boards to suit these boxes. In several cases certain patterns could have been moulded more economically in smaller boxes, but this fact was ignored because of the desire to limit the number of different sizes in use. As far as possible, the patterns have been designed and constructed so as to be self-moulding, thus reducing core-making to a minimum.

Sand Handling

Since the potential demand for castings was assessed at 200 tons per month, it was necessary to explore the various systems of sand and mould handling, and mould making, using the CO_2 process, and to choose the most adaptable system. It was finally decided to adopt the NOMAD pallet-conveyor system, which is manufactured by Hepburn Conveyor Company, Limited, of Wakefield, for handling the patterns and moulding boxes, whose supply also covered the following equipment: a Sandslinger for ramming the moulds after the patterns had been faced with CO_2 sand; a rollover strip machine for stripping the patterns from the moulds and inverting the moulds, and a complete sand-handling and conditioning plant,

including a knockout machine, screen, storage hoppers, mixers and belt conveyors. The complete sand-handling plant was designed to suit the local layout, having an output of 15 tons per hour of backing sand to give a production rate of 80 complete boxes per day. The knockout and sand-handling and treatment section incorporates a Pangborn Ventrijet wet dust-collector.

Steel Pallets for Patternplates

The general layout and details of a typical patternplate are shown in Fig. 2, and it will be seen that the patternplates are carried on steel pallets which travel on rails. Pallets of this type were chosen in preference to roller conveyors for two main reasons: first, because the largest-size moulds, including the patterns and sand, weigh over one ton, and travel with much less effort and with a considerably smoother action than on normal roller-tracks; secondly, since the pattern boards are bolted on to the steel pallets, they are protected from damage caused either by rough handling, or during turning over and stripping, and should therefore last considerably longer.

As only three sizes of moulding box are used, the patternplates are required in only three sizes, all of which are accommodated on the standard size of steel pallet. These pallets are 53 in. square, and are drilled to take the pin centres of the three sizes of patternplates and moulding boxes. The drilled holes are used to fasten the pattern boards to the pallets, using a collared pin which is bolted to the underside of the pallet. The pallet, which carries the pattern boards and moulding boxes, is so designed that when the unit reaches the rollover moulding machine it passes on to a specially-designed table, incorporating sections of the rail track, and is automatically clamped there.

Moulding Sequence

Fig. 3 shows the general layout of the moulding section, and details of the conveyor track, turning tables, pallet and pattern arrangements. The rectangular shape of the track is designed to allow up to six pallets and pattern boards (three bottom boards and three top boards) to be in use at the same time. As it takes only a few minutes to change the pattern board on to a pallet, pattern changes are frequently carried out throughout the day.

The patterns and pallets awaiting use are stored on the long length of conveyor track, where they are faced with CO_2 sand. They are then moved in an anti-clockwise direction to the short side of the rectangular track, where the moulding box is located on the pattern board as shown in Fig. 4. These moulding boxes have been returned from the knockout grid by a short length of roller track. On this section any necessary lifters or gaggers are placed in position in the top halves of the moulding boxes. The assembly then passes along the second long length of track, on which the moulds are completed by ramming with a Sandslinger. All backing sand fed to the Sandslinger is re-conditioned and returned automatically by a sand-conditioning plant.

Turnover

The rammed moulds then pass to the rollover-machine table and are clamped in position. During the turnover operation, the moulding box is held in position by two beams placed across the bottom of the moulding box on to which four chains are fixed. The other ends of these chains are linked to a compressed-air cylinder beneath the machine table. When the compressed air is applied, the chains automatically tighten and take the weight of the moulding box during the turnover operation.

FIG. 3.—*The moulding section at the Penygroes foundry, showing details of the conveyor track and pallet and pattern arrangement.*

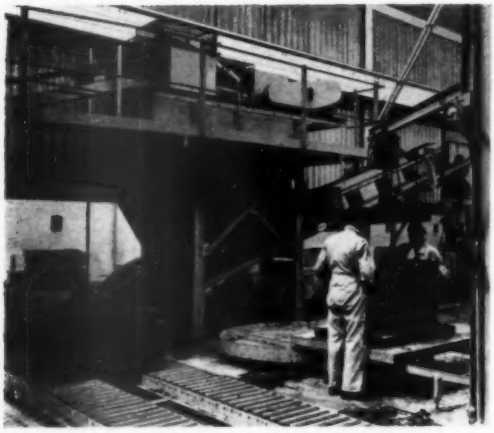


FIG. 4.—*Locating a moulding box on a pattern board, in the moulding shop.*

Simultaneously, this action reinforces the clamps holding the pallets on to the table of the machine. The pallets and pattern board are vibrated by a vibrator built into the table of the moulding machine, and make contact with wrapping blocks welded on to the underside of the pallets. It is therefore the pallets that take the wear and tear and not the pattern boards.

Gassing

After the turning-over operation the chains are released and the beams removed, so that the moulds are lowered away from the patterns. The moulds then pass on to the CO_2-gassing section. With good patterns and moulding tackle, the moulds are such that there is no need for any finishing—in fact, this operation is strongly discouraged. The moulds are then gassed. A framed board is placed over the moulding-box joint and gas enters the mould cavity through a hole in the board. The gassing time for all moulds has been pre-determined, and is controlled by a CO_2-gas flow-meter incorporated in the pipe line. After gassing, the moulds are lifted by overhead crane into the pouring bay where, after being blacked, cored and closed, they remain until casting up takes place.

When the patternplates have been released from the rollover machine, the pallets return by the second short side of the rectangular track to the CO_2-sand facing section. Whereas the existing plant is capable of meeting present demand, provision has been made to duplicate the moulding section when required. The sand-handling and conditioning plant is capable of dealing with this extension.

Conclusion

As originators of the scheme, Austin Hopkinson & Company, Limited, have fulfilled their intention to increase their capacity by equipping one of the most modern foundries in the country. All materials cast in the foundry are subjected to strict metallurgical control and analysis in a well-equipped laboratory. The buildings are well appointed, and modern showerbaths and canteens are among the facilities provided.

Main Contractors and Suppliers.

Metallurgical and foundry consultants	Guthrie, Adams & Company, Leeds.
Moulding and sand-handling plant (including Sandslinger and Pneulec turnover machine)	Hepburn Conveyor Company, Limited, Wakefield.
Induction-melting furnaces	Birlec-Efco (Melting), Limited, Aldridge.
Agents for factory erection	Wales and Monmouthshire Industrial Estates, Limited, Treforest. Architect: D. Maxtone Craig, A.R.I.B.A.
Building contractors	William Cowlin & Son, Limited, Bristol.
Solid carbon-dioxide	Imperial Chemical Industries, Limited, Billingham Division.

Cammell Laird's Capital Spending

Heavy capital expenditure in 1959 is reported by Admiral Sir Michael Denny, chairman of Cammell Laird & Company, Limited, holding company of shipbuilders and engineers. At the year-end there were outstanding contracts for capital expenditure of £2,638,000—£2,420,000 was for the shipbuilding subsidiary and £218,000 for the steelmaking subsidiary.

During the year, the chairman states, the policy was continued of ploughing back retained profits into large-scale modernization schemes, both at Birkenhead and Wednesbury. These schemes, particularly at Birkenhead, were already showing results. He said that although conditions had improved in the steel industry and there had recently been a few more inquiries for ships, 1959 had been a difficult year.

Net profit declined from £689,775 to £272,391 and the dividend is effectively reduced from 15 per cent. to 7 per cent., but with the 4 per cent. final dividend there is a capital distribution of 2½ per cent. (nil).

Progress on Kariba Power Scheme

The second of the six 100 mw generators to be supplied by Associated Electrical Industries (Rugby), Limited, to the Kariba hydro-electric station in Northern Rhodesia, has now been commissioned. The Kariba power scheme was opened by Queen Elizabeth the Queen Mother on Tuesday.

The first generator, and equipment at three 330 kv substations, began to supply electric power to the Northern Rhodesian Copperbelt last December. Two more substations, Norton and Salisbury, have been commissioned to coincide with the coming into load of the second generator. Originally the six generators were to be commissioned at the rate of two a year, but now three will go into service this year, two in 1961, and the last in 1962.

AEI switchgear division has already sent all materials for the Kariba switching station and substations. Nineteen of the 25 330 kv lenticular tank oil circuit breakers have already been sent.

Techniques of Pig-iron Production

Alternatives to the Blast-furnace as a Reduction Unit

Founders who keep abreast with literature on ironmaking techniques may have been wondering what impact certain alternative reduction processes, now being applied commercially, would have on traditional blast-furnace production. The following article well serves to put the whole matter into perspective; it is based on a paper which Dr. J. Taylor presented at a meeting of the West of Scotland Iron and Steel Institute recently. The conditions necessary for the efficient separation of iron from the gangue produced in the reduction of iron oxide are first considered, followed by a review of the alternatives to the blast-furnace, involving the production of solid iron by gaseous reduction or by reduction with solid carbon, or the production of liquid iron. Each of these is examined for advantages and disadvantages, and it is concluded that in normal circumstances no other process is as yet so efficient as the blast-furnace. It is important to realize that pig-iron is still the ironfounder's most important raw material, and still figures highest in his overall raw-material costs.

There has been a growth of interest over the last 20 years in methods for the production of iron other than the blast-furnace. The array of new processes is now so extensive and the claims made so sweeping that it is difficult to keep in touch with the literature and still more to attempt to assess each new process on its merits. Even though the economics may be largely governed by local factors, a technical evaluation must be made first. In this paper an attempt is made to formulate basic technical factors which many of the processes have in common.

The primary aim in ironmaking is to reduce iron oxide to iron and to separate the iron from the accompanying gangue. For economic reasons one is restricted to carbon and hydrogen in various forms for the reducing agent. Consider first the gaseous reduction of iron oxide by carbon monoxide or hydrogen. The equilibrium gas compositions for the reduction of FeO are as shown in Table 1.

TABLE I.—*Equilibrium Gas-ratios for Reactions.*

Temp. deg.C.	$FeO+CO=Fe+CO_2$ pCO/pCO_2	$FeO+H_2=Fe+H_2O$ pH_2/pH_2O	$C+CO_2=2CO$ pCO/pCO_2	$C+H_2O=CO+H_2$ pH_2/pH_2O
300	0.15	6.3	—	—
500	0.53	3.1	—	—
700	1.1	2.0	—	—
900	1.8	1.5	5	5
1,200	2.9	1.2	30	22
1,500	4.8	1.2	100	55

These figures illustrate that CO/CO_2 ratios increase with increasing temperature, while H_2/H_2O ratios decrease. Below about 850 deg. C., CO is potentially more efficient that H_2 as a reducing agent for iron oxide, while above 850 deg. C. the reverse is so. In the presence of solid carbon the $C\text{-}CO_2$ and $C\text{-}H_2O$ reactions become the controlling factor above about 900 deg. C., and, as shown in Table 1, the CO/CO_2 and H_2/H_2O ratios then become very large.

While in any industrial process the equilibrium in a reaction is an essential first criterion, the rate at which equilibrium is approached is frequently a more important limiting factor in practice. Like all chemical reactions the specific reaction rate for the reduction of iron oxide increases with temperature. However, once sintering and glazing of the solid surface begins, which may be at temperatures as low as 700 deg. C., it exercises a retarding effect on the reaction because of poorer gas/solid contact. The result is that the rate of gaseous reduction reaches a maximum at 850 deg. C., and then rapidly declines.

An important point to be borne in mind is that the rate also diminishes with decreasing oxygen content so that, even at the maximum, removal of the final 3 to 4 per cent. of oxygen is slow. Complete reduction of iron oxide by gaseous reduction is therefore not easy to achieve. In contrast to CO the thermodynamics for the reduction by solid carbon become more favourable with increasing temperature. Also in this instance high temperatures are essential for rapid reaction. At lower temperatures it is a solid/solid reaction which is always slow, but after the formation of primary slag it is a liquid/solid reaction and it is known that this is very rapid indeed. A drawback to this high-temperature reduction is that the carbon is only converted to CO, which means that less than 30 per cent. of the potential heat of the carbon is utilized.

Advantages and Disadvantages of Blast-furnaces

It is the great virtue of the blast-furnace process that it operates on the counter-current principle, both with regard to the exchange of thermal and chemical energy, and combines therefore the advantages of both methods of reduction. Reduction of iron oxide by CO to the extent of 50 per cent. is carried out in the lower temperature range and is completed by reaction with solid carbon at high temperatures. In good operation the CO/CO_2 ratio

of the exit gas should be about 1.2, which represents 60 per cent. utilization of the potential heat of the coke. If allowance is made for the recirculation of heat as hot blast, this 60 per cent. is raised to nearer 80 per cent. Even if few blast-furnaces are as yet operating at this efficiency the figures indicate the capabilities of the blast-furnace process.

An important subsidiary advantage of the blast furnace is that the product is molten high-carbon iron, which separates easily and cleanly from the molten slag and is in a convenient physical form for charging into a steel furnace or for casting into solid ingots. Moreover, the high carbon, supplemented by the phosphorus and silicon also present, raises the activity coefficient of sulphur to some 4.5 times that in simple iron solution. This, together with the low oxygen potential associated with the high carbon content, means that desulphurization is much more efficient than when a low-carbon iron (steel) is being made. As sulphur is present in all the common fossil fuels, desulphurization is of critical importance.

Against these advantages must be set the following possible disadvantages, namely, metallurgical coke is an essential requirement; fine ores must be agglomerated before charging into a blast furnace; blast-furnace iron has a high content of impurities, and these must be oxidized out in the subsequent steelmaking process. The first of these is by far the most important stimulus towards the search for an alternative process. Coal suitable for the production of metallurgical coke is exceedingly scarce in large areas of the world, although the older centres of the iron industry in general have ample supplies. The other two items are rapidly losing their importance. The value of ore fines has been enhanced by developments in blast-furnace technology towards high sinter burdens. Again, there has been much talk about the value of low-carbon solid iron, synthetic scrap, in achieving a more favourable scrap/hot metal ratio in steelmaking. It seems certain, however, that the impending revolution in steelmaking will detract greatly from the cogency of this argument. Far from being a disadvantage, the metalloid impurities are essential to the pneumatic steelmaking processes. It is confidently expected that the new oxygen-blowing processes will come to dominate hot-metal practice and that normal sources of scrap will be quite adequate to meet the requirements of the open-hearth and electric steelmaking plants. Moreover, the indications are that the pneumatic processes will be the more economic, at least for ordinary grades of steel.

Three Groups

Conventional processes for the production of iron can be conveniently divided into three groups:—(1) Production of solid iron by gaseous reduction; (2) production of solid iron by reduction with solid carbon; (3) production of liquid iron.

Preliminary to a discussion of these it is useful to indicate the thermal requirements for the iron smelting process as carried out in the blast-furnace. These (in per cent.) are as follow:—Reduction of iron oxides, 64; reduction of metalloids, 7; dissociation of limestone, 6; heat into pig-iron, 12; heat into slag, 7, and cooling losses, 4. These figures are subject to slight variation for different types of burden and operation and certain items would be very different for non-conventional processes. Nothing, however, can really affect the fact that approximately two-thirds of the total heat requirement is for the reduction of iron oxide.

As gaseous reduction of iron oxide is slow, the major problem is, how to speed up reaction rates. In the first place that means operating at as high a temperature as possible. In the second place it means achieving highly efficient gas/solid contact. The solid must therefore be either (*a*) highly porous or (*b*) finely divided. For the porous solid in relatively large sizes, a shaft furnace is an efficient method of achieving gas/solid contact and it is in fact used in the Wiberg process. Efficient gas/solid contact when the particle size is small is more difficult. The multiple hearth roaster has long been used for this purpose and was tried for some of the earlier work on iron ore. It is, however, clumsy and slow in operation and is on the way to becoming obsolete even in the non-ferrous field. The rotary kiln can also be used for this purpose and several projected "direct iron" processes are based on this apparatus. It is not, however, a very efficient method of achieving gas/solid contact and the throughput is rather poor.

Disappointing Feature

Far the most efficient method of achieving gas/solid contact is the fluidized bed, and not surprisingly several processes are based on it. One disappointing feature is that the onset of sintering disturbs the operation and maximum operating temperatures are restricted to between 600 and 700 deg. C., so that the advantage of the very efficient gas/solid contact is to some extent offset by the lower operating temperature. More serious is the fact that it is really a batch process and if continuous operation and a high degree of reduction are required it is necessary to have two or more beds in series.

Another restriction arising from the lower operating temperature is that CO cannot be used as the reducing gas. The reason is that the carbon deposition reaction $2\,CO = C + CO_2$ reaches its maximum over iron catalysts at about 550 deg. C. Except, therefore, for the Stelling process, which aims to produce cementite rather than iron, gases with a high CO concentration cannot be used in a fluidized bed reactor, which aims to produce a highly reduced iron.

A feature of all gas-reducing processes is that the efficiency of conversion to CO_2 and H_2O is poor. It is necessary, therefore, to remove the CO_2 and H_2O and re-cycle the reducing gas. This can be done either by reducing the CO_2 to CO over carbon at high temperature or by condensing out water. Because of the high re-cycling load, how-

ever, this is expensive in energy. For instance, in the Wiberg process the CO_2 is reduced by passing the gas over coke in an electrically-heated retort, and this is one of the heaviest energy consumers of the process.

Finally, there is the important problem of separating and compacting the product. In processes producing solid iron, whether by gaseous or solid reducing agent, no separation of iron and gangue takes place. Magnetic separation of iron from gangue would appear to be a straightforward operation, but separation is possible only if the particles are free. In the Wiberg process, where pelletized ore is reduced, it is obvious that post-separation is, if not impossible, at least very difficult. Similarly in processes where incipient sintering has occurred, which includes all the solid reduction methods, adhesion of gangue and iron takes place and post-separation is inefficient, so much so that a material low enough in gangue for steelmaking cannot be produced in this way from a low-grade charge. The alternative is to concentrate the ore before reduction. It is important to appreciate, however, that many ores cannot be concentrated to the desired extent and mineral dressing operations designed to give a high-grade concentrate are usually rather costly. Compaction of the iron powder is usually a straightforward briquetting operation but it is an additional operation and it is necessary.

Reduction by Solid Carbon

The first problem here, as in the gas/solid processes, is how best to achieve efficient contact between ore and reducing agent. The only solutions appear to be to crush and compact, or crush and mix by mechanical means. An even more important fundamental difficulty arises with regard to the heating of the charge. A process of this type would preferably be carried out at not less than 1,000 deg. C. in order to speed up reaction rates. The heat requirements in the reaction zone are high because of the strongly endothermic reduction process

$$FeO + C = Fe + CO.$$

At 1,000 deg. C., however, the equilibrium in the reactions

$$C + H_2O = CO + H_2$$
$$C + CO_2 = 2CO$$

are so far to the right that in the presence of excess carbon a carbonaceous fuel can only be burnt to CO and H_2 with disastrous consequences to thermal efficiency. Clearly it is essential to achieve a considerable conversion of the heating fuel to CO_2 and H_2O. Equally clearly this cannot be achieved if there is intimate contact between heating gas and charge as in the blast-furnace. This in turn raises another fundamental problem, that of heat transfer. If one cannot have intimate contact between heating gas and charge heat, transfer must be by radiation and conduction, and the conductivity of a bed of finely-crushed solids is notoriously poor.

This latter is the most serious objection to one of the oldest processes for solid/solid reduction, the Hoganas. In this process the charge is packed into saggars, which are externally heated. Because of the low thermal conductivity, output is poor and as mechanization is difficult it is unlikely that the process will ever be extended beyond its present application, which is the production of high purity iron for special steels.

A much more satisfactory technical approach to the heating problem is that of the Krupp Renn process. The inspiration for this process seems to have been the Waelz kiln as used by the zinc industry. In the Waelz process a charge of zinc residues and carbon passes through a long, internally-heated rotating kiln. At the operating temperature the charge melts, the rotary motion brings about intimate contact between melt and carbon and also increases the rate of heat transfer from combustion gases to charge. The heating fuel is burnt completely and the combustion gases are strongly oxidizing, but the carbon maintains strongly reducing conditions in the charge. Zinc oxide is reduced, the zinc vapour passes into the gas phase, where it is, of course, reoxidized and thence recovered as zinc oxide dust.

Basically the Krupp Renn process is the same. In this instance, however, particles of iron are formed which, by a process of re-oxidation at the slag surface followed by reduction below the surface, grow to pellets up to 1 cm. dia. These pellets can be efficiently recovered by magnetic separation and are sufficiently large not to require further agglomeration. The Krupp Renn process then provides a neat solution to the problems of thermal efficiency and separation and recovery of iron from low-grade ore, but there are several important drawbacks. Like all rotary kiln processes of this type, ring formation and refractory attack are serious problems. A more fundamental problem is that of sulphur pick-up. In part, because of refractory attack, it is necessary to operate with a highly silicious slag, which means that desulphurization is practically nil. Since virtually all carbonaceous fuels contain sulphur, the sulphur input to the kiln is high and a product containing 1 to 2 per cent. sulphur is obtained. Such material is quite unsuitable for steelmaking and, in fact, the only satisfactory outlet is to charge it into a blast-furnace. The Krupp Renn is, therefore, more properly regarded as a concentration process for upgrading lean ores prior to blast-furnace smelting.

Sulphur pick-up, slag constitution, and refractory wear are closely related phenomena in a rotary kiln process. Either one can have an acid refractory and an acid slag, as in the Krupp Renn, or a basic refractory and a strongly basic slag. Unfortunately the latter then becomes a very refractory slag and operating temperatures of between 1,500 and 1,600 deg. C. are required to melt it. The intermediate slag of the blast-furnace type would certainly cause serious wear on either acid or basic refractories. One way of surmounting the difficulty is by operating below the temperature of slag formation. Limestone added to the charge does not go into solution and the

thermodynamic activity of the calcined lime is high, which favours desulphurization. At temperatures below that of slag formation there should be little attack by solid lime on acid refractories.

The R.N. process, which currently appears to be one of the more favoured solid-reduction methods, operates on these lines. There are, of course, disadvantages in an operating temperature (of about 1,000 deg. C.) below that of slag formation. Contact between reducing agent and charge is poorer which decreases throughput. The more open nature of the charge exposes a greater surface to oxidation by the combustion gases and it is necessary to maintain a large excess of solid carbon. The excess is recovered and recycled, but at additional cost. Lastly, separation of the products is poor. A high-grade product can be produced from a high-grade concentrate, but the product from lower grade ore has too high a gangue content and is only suitable for blast-furnace feed.

One obvious method of supplying the thermal requirements of a solid-reduction process is electrical and several attempts have been made along these lines. Quite apart from the question of whether such a high-grade form of energy can be economic, there are obvious practical difficulties in generating heat from electricity in a rotating kiln.

Production of Liquid Iron

It is not intended to discuss electro-smelting under this heading. The principles are well understood and the application turns almost entirely on the cost of electricity. It must be very low before the process can compete with the blast furnace.

Operation of a rotary kiln could obviously be modified to produce liquid iron and experiments along these lines have been made. A major difficulty has already been discussed, that of slag composition and refractory attack. A further point is that the reducing carbon will tend to float on the slag surface out of contact with the iron so that a low-carbon iron will be produced. This has obvious attractions, but account must be taken of the fact that the melting point, and therefore the temperature of operation, will be raised. Also, desulphurization of low-carbon iron is more difficult. These objections can be met by raising the lime content so that the slag is semi-solid, but, of course, only at the expense of a serious increase in the thermal load and fuel requirements. A process of this type (Basset) has operated for some years in Denmark and the extra operating cost covered by using the slag as cement clinker. Apart from any other consideration, coupling iron production to cement production imposes serious restrictions.

A further line of approach that has received much attention in recent years is the so-called low-shaft furnace. This is, in fact, simply an attempt to operate a blast-furnace with carbon other than metallurgical coke. The method is to incorporate the carbon (coal or coke) with the ore and briquette the product. The intimate mixture of coal and ore means that practically all reduction is by the reaction $FeO+C=Fe+CO$ and the exit gas has a high CO/CO_2 ratio. The thermal efficiency of such a process is poor and a use must be found for the large volumes of exit gas of low calorific value.

In many ways the most attractive approach is that of flame smelting. The idea is to smelt finely powdered ore in a gas phase suspension, that is, more or less as an extension of the powdered-fuel burner.

There is, however, an important difference between complete combustion of coal and combustion to give the highly-reducing gases necessary for the reduction of iron oxide. In the first instance oxidation of carbon particles can take place not only directly with oxygen but by the two reactions

$$C+CO_2=2CO \text{ (gas/solid).}$$
$$2CO+O_2=2CO_2 \text{ (homogeneous gas).}$$

The concentration of oxidizing gas remains substantially constant and so should the reaction rate. In the second instance we are concerned only with the first of these reactions. As the reaction proceeds the concentration of the reactants decreases and hence the rate of reaction. It is not unexpected, therefore, that a high CO/CO_2 ratio is difficult to achieve and carry over of unreacted carbon tends to be high.

It is much easier to burn hydrocarbon fuels to give a reducing gas, but, as pointed out earlier, when fuels are burnt only to $CO+H_2$ the hydrogen content of the fuel can make no contribution to the heat developed. It might appear from Table 1 that a considerable conversion to CO_2 and still more H_2O is possible. The values shown refer, however, to pure FeO. If the FeO is in slag solution, as it must be in flame smelting, these figures must be amended. For instance, if the aim is not more than 2 per cent. FeO in the slag then the corresponding equilibrium gas ratios must be multiplied by a factor of about 50, allowing for deviations from ideality of the slag solution. Under these conditions the reducing gases are practically all $CO+H_2$. The effect of this on the available heat at 1,500 deg. C. is illustrated in Table 2 for coal and heavy fuel-oil burnt in oxygen to give $CO+H_2$.

TABLE 2.—*Comparison of Availability of Heat in Coal and Fuel-oil.*

—	Available heat at 1,500 deg. C., B.Th.U. per lb.	Per cent. of total calorific value
Coal	1,100	8
Fuel-oil ..	850	4.5

These figures show how much inferior hydrocarbon fuels are under these conditions. Still more significant is the fact that, even for coal burnt in oxygen, the available heat at 1,500 deg. C. is only 8 per cent. of the potential heat. A single-stage flame smelting process offers no prospects of success, the only line of attack seems to be to use the chemical and thermal energy of the gases from the smelting unit to prepare the charge for smelting. In other words, to achieve in two or more stages

that counter-current exchange of thermal and chemical energy that the blast-furnace achieves in one.

Conclusions

The modern blast-furnace is a highly efficient smelting unit. Where adequate supplies of coking coal are available it has, as yet, no rival. What were formerly regarded as two important drawbacks, the high impurity content of the metal and the necessity to agglomerate fine ore prior to charging, promise to be assets rather than liabilities. Conversely the fact that low-carbon iron may be produced from ore fines by non-conventional methods is a less certain advantage of those methods than had been thought. The one sure asset of such methods is the ability to dispense with coking coal.

The major problems that arise in the development of non-conventional methods are:—

(1) Efficient use of the thermal and chemical energy of the fuel. None of the newer methods utilize fully the principle of counter-current flow on which blast-furnace efficiency rests. The problem has been solved in some instances, notably the rotary kiln methods, but in others it is a major preoccupation.

(2) The separation of gangue and iron is a most important problem in all processes carried out below the fusion point of both gangue and metal. Separation of the products is very inefficient. A product low enough in gangue can only be obtained from high-grade concentrates; otherwise the gangue content, even after magnetic separation is too high for use in steelmaking and must be charged into a blast-furnace. The production of high-grade concentrates is only possible with certain ores.

(3) Sulphur pick-up is a serious problem in those processes in which slag formation occurs. It is not always realized that in the blast-furnace the low oxygen potential of the slag and the high metalloid content of the metal are at least as important as slag basicity in controlling the sulphur. Failure to reproduce these conditions is bound to lead to serious desulphurization troubles.

(4) In most processes carried out at temperatures below the fusion point of slag and/or metal complete reduction is difficult. Oxygen contents of the order of 5 per cent. are common and this should be taken into account when assessing the value of the product as steel melting stock.

One further point may be made. In general, it would appear a very dubious policy to use these new processes to produce what is in effect low-grade scrap for charging into the blast-furnace. Krupp Renn furnaces are doing just this in a number of places and it has been suggested that the R.N. process could be employed in the same way.

It may be the most economic way of utilizing certain rather difficult lean ores. One suspects, however, that the rapid advances in blast-furnace efficiency over the last few years are not always taken into account. The coke required to melt scrap should be much the same whether the furnace is operating at low or high efficiency, and should be 4 to 6 cwt. A few years ago 16 cwt. per ton iron was recognized as fairly good practice for rich ores, whereas now 12 cwt. is being achieved. The saving in coke from charging scrap is very different in the two instances.

Shipbuilding Inquiry Sub-committee formed

A sub-committee to inquire into the future of the shipbuilding industry has been established by the Shipbuilding Advisory Committee of the Ministry of Transport. The wide terms of reference of the sub-committee are "to review the prospects of and the problems facing the shipbuilding and shiprepairing industries and to make recommendations."

The sub-committee will make its report to the main committee. Its chairman will be Sir James Dunnett, Permanent Secretary to the Ministry of Transport, who succeeded Sir Graham Cunningham as chairman of the main committee following Sir Graham's resignation earlier this year.

Members of the sub-committee are from the following organisations.—Shipbuilding Conference: Col. T. Eustace Smith, president, and chairman and managing director of Smith's Dock Company, Limited, Middlesbrough; Mr. A. H. White, chairman and managing director of Lithgows, Limited, Port Glasgow; and Mr. R. B. Shepheard, director of the conference. Shipbuilding Employers' Federation: Mr. G. H. R. Towers, chairman and managing director of John Readhead & Sons, Limited, South Shields; Mr. R. W. Johnson, a director of Cammell Laird & Company, Limited; and Mr. N. A. Sloan, a director of the confederation. Confederation of Shipbuilding and Engineering Unions: Mr. E. J. Hill; Mr. G. H. Doughty; Mr. H. G. Barratt; and Mr. A. Williams.

£10,000,000 Expansion by John Lysaght

A development scheme costing £10,000,000 at the Normanby Park, Scunthorpe, steelworks of John Lysaght, Limited, has been approved by the Iron and Steel Board. This is the third post-war development scheme at the works and a continuation of the second £13,500,000 plan. It is expected to be completed in 18 months.

The new scheme will include the installation of new mining equipment at the company's open-cast ironstone quarries in the Scunthorpe district and the underground mines in the Caistor area of north Lincolnshire. Two other major features of the work are the addition of a third sinter strand to the ore preparation plant and the increase of the hearth diameter of the Normanby Park blast furnaces.

It is expected that the expansion will increase the steel-ingot production at Normanby Park from 600,000 tons a year to about 900,000 tons. The company is also laying down one of the new continental oxygen steelmaking plants. The project will provide jobs for 150 to 200 more men.

A few weeks ago, the Appleby-Frodingham Steel Company, branch of the United Steel Companies, Limited, announced a £28,000,000 expansion of its steelworks at Scunthorpe. The Redbourn Works of Richard Thomas & Baldwins, Limited, at Scunthorpe are at present being modernized and expanded at a cost of £23,000,000.

British Non-Ferrous Metals Research Association

Annual Report and General Meeting

The British Non-Ferrous Metals Research Association has recently published its annual report for 1959, and the following extracts have been made from those sections having particular interest for foundrymen:—

During 1959, further contributions towards the new laboratory block opened a year ago brought the total from members, plus the Department of Scientific and Industrial Research earned grant, to £107,500—a substantial proportion of the £130,000 which the expansion cost. The expanded research programme which the extra laboratory space and increased industrial support allows has necessitated an increase in staff. Seven additional qualified scientists were engaged in 1959, bringing the total staff to just over 170, and recruitment of more staff is proceeding as scientists of the right calibre are found.

Among the new researches listed in the Association's annual report are investigations into the prevention of air-pollution, effluent treatment, nickel additions to gunmetal, "hard spots" in cast and extruded brasses and corrosion cracking of copper alloys. In the light-alloy field, new researches include directional properties of medium-strength alloys and tests for serviceability of bright anodized aluminium. In the nuclear-energy field, there are new researches on the absorption of hydrogen by metals and intercrystalline fissuring and cavitation. A fundamental study of the oxidation of zinc has also been started, and a new study of cobalt additions to nickel-plated solution.

Foundrywork

For some time research has been in progress aimed at bringing about a more scientific approach to the running, gating and feeding of castings, since failure to appreciate the principles is the root cause of the greater part of foundry scrap and poor castings. The work on gunmetals has recently been completed, with demonstrations of the application of the principles found in the research to the production of a flanged half-bearing and a water-valve body. Parallel work is continuing with aluminium-bronze.

The results of the work on the relationship between the constitution of gunmetals and their properties and casting characteristics was issued during 1959 as a pamphlet "Gunmetals—Choosing the Best", and about 6,000 copies were distributed through member-firms. The work led to the development of the "BNF Gunmetal"—an alloy giving more-uniform properties in thin and thick sections and having excellent pressure-tightness. Its inclusion in the new British Standard for copper-alloy casting has been recommended. It is also hoped that an improved test-bar for gunmetals, recommended on the basis of extensive laboratory and co-operative foundry trials, will be accepted by the British Standards Institution.

Investigations into the casting of high-silicon aluminium alloys has been the main feature of the foundry programme for the aluminium industry. These alloys are being considered by the motor industry for cylinder-blocks and other parts where their lightness, low expansion and good wear-resistance are attractive features. Ways of improving stress corrosion resistance of the high-strength casting alloys, such as L53, have also been examined.

Process Control

Considerable progress has been made with the application of the X-ray fluorescence method of analysis to the accurate determination of major alloying constituents in copper alloys and some other non-ferrous metals, both with the Association's own X-ray spectrometer and also with an automatic commercial instrument loaned for demonstration purposes. It has been shown how inter-element effects can be overcome, greatly increasing the scope of the method. Largely as a result of this work and the demonstrations that have been given at the laboratories, instruments are being installed in industry for routine analytical control. Other researches on instrumentation have been concerned with radiation pyrometry as applied to aluminium alloys, and with the eddy-current testing of tubes for minor manufacturing defects.

Plating of Die-castings

The results of the most important work carried out in the metal-finishing section during the year were recently published in a development report "Better Plating on Die-castings." This work shows that thicker crack-free chromium coatings applied by modifications to the normal plating procedure can improve very substantially the corrosion resistance of plated zinc-alloy die-castings. Considerable evidence is provided in the report of the better performance during outdoor exposure tests—some in highly-corrosive atmospheres—of castings so treated. This work on die-castings has confirmed the importance of an adequate thickness of nickel under the chromium, emphasizing the need for a simple, accurate method of checking nickel thickness. To meet this, the BNF plating gauge has been much improved in simplicity of operation, stability and accuracy.

Annual General Meeting

The 40th annual general meeting of the British Non-Ferrous Metals Research Association, held at the Savoy Hotel, London on May 11, was the first occasion on which Mr. F. C. Braby, M.C., D.L., presided, after taking over the chairmanship of the Council from Dr. Maurice Cook, C.B.E., in

(*Continued at foot of page* 621)

Cast-iron New Year Cards*

From 1805 to 1848, the Royal Ironfoundry in Berlin sent cast-iron New Year cards to the Prussian King, local dignitaries and their business associates. These "cards" were actually thin iron castings.

Cast New Year cards seem to have had their origin at Gleiwitz, Silesia, in accordance with the customs of the local mining community. Count Reden, Chief Inspector of Mines at the beginning of the 19th century, was very keen on tradition, and is known to have encouraged the issue of these plaques. The first one (1805) illustrates two crucible furnaces in use at the Royal Ironfoundry, in Berlin (where the cards were produced), and the past year's products there, such as tubes for the Royal Porcelain Factory, gear wheels, etc. During 1805 the foundry was rebuilt, and the plaque for the year 1806 depicts the interior of the new plant, two cupolas and one reverberatory furnace being shown. The plaque for 1808 gives a view of one of the two cast-iron bridges erected in the garden of the Royal Palace at Charlottenburg (each of which weighed over three tons). The 1810 plaque shows the interior of an even larger foundry, with a jib crane with block and falls, an iron moulding-box, a flywheel and a paper press.

Historical Motifs

The plaque for 1811, and subsequent ones, have historical motifs, since they commemorate the years of the Napoleonic wars. The 1811 plaque illustrates two gun barrels and a pile of cannon balls, together with a pair of calipers for the measurement of the latter. In the background are two moulding benches, with sand, a seive, a shovel and a rammer. The Card for 1812 has a surround of a cast-iron chain, alluding to the foreign occupation, and that for 1813 has the inscription: "Hail our King and hail through him to the mining industry." To mark Napoleon's defeat, the plaque for 1815 shows the Brandenburg Gate in Berlin, with the goddess of peace surmounting a quadriga. This sculpture had been taken to Paris by the French troops during the occupation, but was brought back by the victorious Prussian army in 1814. The goddess of peace was changed into a goddess of victory by adorning her head with a victory wreath with cross and eagle.

Visit by Royalty

The 1816 plaque (see Fig. 1) has on its top corners the initials of the emperor Alexander I of Russia, and the Prussian king Fredrick William III, who together visited the Royal Ironfoundry on November 1, 1815, and in whose presence the first plaques for 1816 were cast. Further interesting details of this plaque are cast-iron monuments, a memorial cross, a large mortar and the first steam locomotive cast and assembled on the continent (shown in operation on the occasion of the royal visit). The inscription on this plaque reads: "Glorious weapons can be made from iron, but in the arts it creates ornaments and profit, may God bless iron work."

FIG. 1.—*Cast iron New Year card for* 1816, *commemorating a visit by Royalty to the Berlin Ironfoundry.*

* Abstracted from the German magazine *Giesserei Praxis*. The original article was taken from "The History of the Royal Ironfoundry in Berlin," by F. Haase.

BNFMRA Report—*Continued from facing page*

January. The continued interest and help of Dr. Cook in the work of the Association is assured by his co-option to Council. Elections to the Council of the Association included: Mr. L. R. Carr, M.P. (of John Dale, Limited), Mr. L. Rotherham (Central Electricity Generating Board), Mr. R. D. Burn (British Metal Corporation, Limited), Mr. S. E. Clotworthy, C.B.E. (Northern Aluminium Company, Limited), Mr. A. H. Carmichael (Cable Makers' Association), Mr. G. Hunt (High Duty Alloys, Limited) and Dr. N. P. Inglis (Imperial Chemical Industries, Limited). Of these, the first two have served for some time as co-opted members of the Council, while Mr. Burn and Mr. Clotworthy were appointed during the year to fill vacancies. (At the annual luncheon of the Association, which is reported elsewhere in the JOURNAL, the president, Mr. F. C. Braby, discussing the year's finances, said that it was hoped to collect a further £50,000 during the current year, largely as a response from certain interested groups of member-firms, and this would help to offset increased commitments, both for laboratory extensions and staffing requirements.)

American Letter

Melting and Pouring of Aluminium-bronzes

Developments in foundry practices in the last 30 to 40 years, permitting proper handling of the aluminium-bronzes, have radically improved their reputation. The following article summarizes present-day methods and techniques in the casting of these alloys. The most important features of aluminium-bronzes are (*a*) unusual combinations of mechanical properties; (*b*) distinct ability to retain these properties at fairly elevated temperatures; (*c*) excellent resistance to corrosion, and (*d*) excellent resistance to wear.

Mechanical Properties

Tensile strength may range from 22.32 to 53.57 tons per sq. in., elongation from 0 to 30 per cent. or better, and Brinell hardness from 110 to 400 (see Table 1). The ability of these alloys to retain their mechanical properties at moderately elevated temperatures far exceeds the performance of other high-strength bronzes,

TABLE 1.—*Typical "As-cast" Mechanical Properties of Aluminium-bronze alloys.*

Chemical composition, (per cent.).					Yield Point (tons per sq. in.).	Tensile strength (tons per sq. in.).	Elongation (per cent.).	Brinell.
Al.	Fe.	Mn.	Ni.	Cu.				
10	—	—	—	90	11.16	29.02	15	121
10	1	—	—	89	13.39	31.25	15	143
9	2	—	—	89	12.50	31.25	30	131
9	3	—	—	88	13.39	33.48	30	146
10	4	—	—	86	15.62	33.48	18	163
9	—	—	5	86	13.39	33.48	35	143
10	5	3	5	77	20.09	40.18	6	187
12	4	—	—	84	17.86	35.71	3	202

such as the manganese-bronzes. The entire alloy group shows excellent resistance to corrosion, and as a result, aluminium-bronzes are used extensively in chemical processing equipment. Resistance to wear is also very good, and aluminium-bronze castings are used for gears, wear strips, cams, guides, etc. These alloys also have high resistance to cavitation erosion; consequently, certain types are used widely in the production of impellers, pump castings, etc. The alloys used most extensively have from 5 to 15 per cent. aluminium content.

Melting

The difficulties associated with melting of aluminium-bronzes depend largely on the type of equipment used. Where electric-arc or low- or high-frequency induction furnaces are involved, however, few melting troubles are encountered when using good practice. Unfortunately, the majority of foundries use gas- or oil-fired crucible or reverberatory furnaces. Aluminium-bronzes exhibit two characteristics which, at least insofar as melting-atmosphere conditions are concerned, appear to work in direct opposition to each other: (1) Ability to absorb hydrogen originating from some form of poor melting-practice, and (2) chemical composition variation during melting, which occurs as the result of oxidation losses of aluminium.

To avoid hydrogen gassing, oil- or gas-fired furnaces should be operated with an oxidizing atmosphere. Too much oxygen means heavy melting losses by aluminium oxidation. It is more important to maintain a consistently correct atmosphere in an open-flame reverberatory furnace than in a crucible furnace. The surface area exposed to the furnace combustion products per unit volume of melt is much higher with a standard reverberatory furnace than with a crucible unit. Generally, therefore, it is preferable to melt aluminium-bronzes in a crucible furnace, rather than a reverberatory furnace.

Charging

The first charge should always consist of ingots or other large solids, and should never include material with a large surface-area-to-volume ratio, such as turnings, drillings, shavings and small castings. This latter material should be charged into the bath of molten metal only after the initial melting down of large solids. Under no circumstances should any aluminium-bronze melt be held in the furnace once the desired temperature has been reached, and the melt should not exceed the selected pouring temperature by more than 50 deg. C. If a flux is required, ordinary salt may be used sparingly before the melt is removed from the furnace. Some foundrymen prefer to mix a small amount of sodium aluminium fluoride or cryolite with the salt, although there is here a danger of creating a liquid slag rather than a dry, easily-skimmed dross.

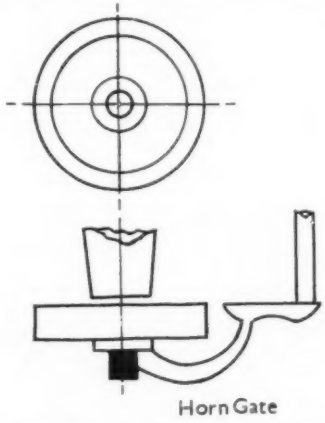


FIG. 1.—*Section view of a horn gate leading into the centre of a heavy circular aluminium-bronze casting directly under the feeder-head.*

Furnace Atmosphere

There are two schools of thought where furnace atmospheres for aluminium-bronze melting are concerned. The first requires that the alloy be melted under slightly reducing conditions, and, before it is removed, swept with nitrogen gas, or exposed briefly to a comparatively heavy oxidizing furnace atmosphere, or treated in some other way to ensure freedom from gas absorption. The second school demands that the furnace exit flame be a rich green colour tinged with yellow, indicative of an oxidizing atmosphere. Use of an oxidizing atmosphere minimizes the possibility of gas absorption. Reducing conditions are of value when reverberatory furnaces are used, but an oxidizing atmosphere throughout the entire melting cycle is recommended for crucible melting.

Moulding

When using green-sand moulding for aluminium-bronzes, the sand must have a comparatively high

* Synopsis of a paper presented at the Missouri Valley Regional Foundry Conference, which was held at Rolla, Mo., from September 24 to 25, 1959. The author, Mr. J. G. Dick, is manufacturing manager, Canadian Bronze Company, Limited, Montreal.

permeability and as low a moisture content as possible. Fine-grained sands or unduly high moisture can cause blowholes, pinholes and general porosity. Hard spots or wet spots in the mould should be avoided by even ramming and proper mulling of the sand. The low moisture content and high permeability of CO_2-hardened moulds are excellently suited for this type of work. Where light and heavy casting sections join, chills may be used to chill the light section directionally to the heavy section, which must be fed adequately by a feeder-head, or some similar means. Conversely, where a heavy section cannot be fed properly, chills may be used to solidify the heavy section directionally toward the light one, which must have a means of receiving hot metal to take up the shrinkage of both heavy and light sections.

Gating

To avoid undue turbulence and subsequent dross formation during pouring, the general technique is to gate into the lowest level of the casting. It is general practice to pour hot metal into the feeder-head, once it has been filled partially by bottom pouring, to ensure adequate feeding of the casting. Ratios of sprue, runner, and ingate areas of the order of 1:2:4 are imperative, and strainer gates, reverse horn gates, skim gates, step gates, etc., are used extensively. The use of pouring basins with plugs, to permit controlled flow into the sprue without turbulence and dross formation, is common. For example, heavy circular castings of uneven cross-section, such as gear blanks, are usually cast with a skim gate and an attached reverse horn gate, the large end of the horn gate leading into the centre or hub of the casting, directly under the feeder-head (see Fig. 1).

Feeding

Feeder-heads must be of generous proportions when feeding heavy cross-sections. The average ratio of feeder weight to casting weight for 20 aluminium-bronze castings poured recently in the author's foundry was 47:53. In recent years, much work has been done to reduce the size of feeders, by the use of exothermic compounds or insulating materials for riser sleeves or pads. A secondary use of exothermic material is to secure a necking-in of the feeder to a small cross-section at the point of its junction with the casting, to reduce cut-off and cleaning costs.

The composition of aluminium-bronze, insofar as aluminium content is concerned, has a definite effect on as-cast structure. For example, the 10 per cent. aluminium alloy cast and cooled in sand shows a tendency toward reduced strength and ductility. The safest procedure when producing aluminium-bronze castings containing more than 9.5 per cent. of aluminium is to knock them out of the sand as soon as it can be assumed safely that the heaviest section has solidified properly. The castings should then be brushed free of sand and allowed to cool in air. Under no circumstances should they be cooled with water, since this action again introduces undesirable structures. Another method of preventing the adverse effects of slow cooling is by the addition of elements to stabilize the structure—small amounts of iron, manganese and nickel can be used for this purpose. Grain-size control can also be achieved by the addition of elements such as magnesium or calcium.

Heat Treatment

As a general rule, only alloys which contain 9.5 per cent. or more of aluminium are heat-treated. One of the most common heat-treatments involves heating the alloy to a temperature within the beta zone and then, after a brief but adequate soaking period, quenching to retain the beta structure. Prolonged heating with attendant grain growth results in a weakening at the beta-phase grain boundaries. Where such a condition has existed during heat-treatment, it is common for castings to break completely when dropped. The addition of iron, manganese and nickel helps to retard grain growth to some extent. Subsequent reheating at temperatures in excess of the eutectoid transformation temperature results in the development of mixtures of alpha and beta, the properties of each depending on the temperature and heating time used. Many combinations of strength, hardness and ductility can be secured by variation of heat-treatment.

Motor-car Market Trends

The International Automobile Show recently completed its run at the Coliseum, in New York City. Vehicles from all the European manufacturers, including Czechoslovakia and Russia, were on show. Japan supplied the Oriental makes, and more than 20 models of British manufacture were also displayed. Britain has always been one of the leaders in car imports to the United States, and in 1959 she shipped in 208,139 units (more than any other country). This year, British automobile manufacturers expect that the expanding US market for foreign cars will enable them to top last year's total. US imports of motor vehicles totalled 718,667 in 1959, 668,070 of which were new passenger-cars, 28,834 used cars and 21,763 trucks.

The United States led the world in new motor-vehicle registrations in 1958, with 4,650,313. In second place was West Germany with 635,524, followed by France 589,584, Great Britain 540,073, Canada 381,591, Italy 209,215, Australia 175,297 and Sweden 147,229. The United States owns 66.1 per cent. of the world's passenger cars, and 4.5 per cent. of its trucks. The world total of passenger-cars in 1958 was 86,139,565, and that of trucks and buses 25,773,276. Nearly three out of every four families in the US own automobiles, 13.5 per cent. of all families having two or more vehicles.

Molten Aluminium transported 105 Miles

Delivery of molten aluminium from Aluminium Company of America's new Warrick works near Evansville, Ind., to the Fabricast plant of General Motors Corporation's central foundry division at Bedford, Ind., is expected to begin in June. These 105-mile trips over the hilly roads of southern Indiana are regarded as a major innovation in the trucking industry. Special insulated vehicles for the haul are being designed and built at the Bedford foundry, it is reported. Each of these trucks is expected to carry from three to six tons of molten aluminium at a temperature of 900 deg. C. It is understood the metal will remain molten long enough to be poured into moulds without reheating upon arrival at the Fabricast foundry.

Molten aluminium has been transported by trucks before but never in such large amounts over such a long distance. For example, it has for many years been common practice to transport molten iron from blast-furnaces to steelmaking furnaces in insulated ladle cars, but such hauling is usually by rail on private right-of-ways.

STUART DAVIS, LIMITED, Bayton Road, Exhall, near Coventry, are holding an exhibition of air equipment at the Queen's Hotel, Birmingham, on May 25. Included in the exhibits will be various types of pneumatic control valves including lever-, foot- and solenoid-operated models. Demonstration panels will be available enabling visitors to try out various types of air equipment and circuits.

F

International Apprentice Competition

An International Apprentice Competition for various trades is to be held in Spain this year. The governing body is the Organizing Committee of the International Vocational Training Competition, whose offices are in Spain, which consists of a president, vice-president, secretary, and an official representative from each participating country. The competition began in 1947 as a purely Spanish venture, but in 1956 a meeting of interested organizations was held in London, as a result of which a small committee, known as the British Organizing Committee was established to make arrangements for selecting a team in this country. At the same time the City and Guilds of London Institute agreed to provide the necessary secretarial and administrative help.

Each of the participating countries is free to submit drawings for the tests which range up to 40 hours duration, and the competition is open to apprentices in following trades:—patternmaking, metal work, electricity, building, silversmithery and jewellery. Other trades may be included in this year's competition. A firm sending a boy to the competition is required to pay the cost of travelling only, the host country pays all the costs of the apprentice's stay during the competition. Firms wishing to submit names of boys for possible inclusion in the British team should write to the director (AC), City and Guilds of London Institute, 76, Portland Place, London, W.1.

Dinner

LLOYD'S REGISTER OF SHIPPING

The oldest and largest ship classification society in the world, Lloyd's Register of Shipping, celebrated its bicentenary with a banquet in Guildhall, London, last Monday. The chairman of the Society, Mr. Kenneth R. Pelly, M.C., presided. Amongst those present were the Rt. Hon. The Lord Mayor of London and the Sheriffs; the Rt. Hon. Lord Merriman, president of the probate, divorce and admiralty division of the High Court of Justice; the Rt. Hon. Ernest Marples, M.P., Minister of Transport, representatives of 29 foreign and Commonwealth Governments, Her Majesty's Ministers, the Hon. W. A. Fox, Minister of Marine, New Zealand, the Bishop of London, the chairmen and members of the national committees and of the Scottish and Liverpool committees, and leading industrialists from many parts of the world.

Stanton Pipes (Canada), Limited

Stanton Ironworks Company, Limited, near Nottingham, announce that their subsidiary in Canada, Stanton Pipes (Canada), Limited, which until now has been a selling company only, has been re-organized as a manufacturing company. A substantial minority interest in the subsidiary has been acquired by National Steel Car Corporation, Limited, of Hamilton, Ontario.

It is the intention of the re-organized Canadian company to establish a new plant at Hamilton on land and in buildings acquired from National Steel Car Corporation, Limited, for the manufacture of spun-iron pressure pipe. Production is planned to start early in 1961. The initial investment involved in this venture is approximately $5,000,000.

India to copy Miniature Cupola

Thorncliffe News, the works newspaper of Newton Chambers & Company, Limited, Thorncliffe, Sheffield, reports that the design of the miniature cupolas which have been constructed by Newton Chambers' apprentices is to be copied at a technical institute in India. Details of the cupola made at Thorncliffe and installed by the works' apprentices at the Rotherham College of Technology recently, were originally published in *Thorncliffe News* and the story was reproduced in the FOUNDRY TRADE JOURNAL. It was at the College that the cupola was seen by Mr. V. P. Soni, principal of the N.R. Technical Institute at Charbagh, Lucknow.

In a letter to the Sheffield company, Mr. Soni wrote that at the Institute the training of railway apprentices included foundrywork, and that he would like the apprentices there to make a similar cupola for use in the Institute. Mr. B. Morton (training officer, Newton Chambers) has now sent Mr. Soni copies of the original plans for the cupola, together with a comprehensive set of figures, with the request that when the cupola is built at Charbagh there may be a plaque referring to Newton Chambers.

In addition to the model in use at the Thorncliffe Training Centre, and the one at Rotherham, Thorncliffe apprentices have constructed to the same specifications a cupola which is in use at the North Lindsay Technical College, Scunthorpe. Thus, this is the second time that the company has supplied construction details and plans.

Extensions for Hepworth & Grandage

A new foundry on a 20-acre site in Sunderland, planned by the Bradford engineering firm of Hepworth & Grandage, Limited, will be the company's first extension outside the West Riding in its 52 years of history. The company decided upon this measure because of the difficulty in obtaining building certificates for expansion in Bradford and the labour shortage in that city.

Speaking of the extension, Mr. Harold Forrest, works general manager, said that the expansion of the motor industry had meant that its components manufacturers and engine builders were having to expand their production facilities, and, he added, that Hepworth & Grandage had felt for some time the need to expand their ring foundry. Although 5,000 were employed by the company in Bradford, difficulties had been experienced in obtaining enough workers, whereas there was an ample supply of labour in Sunderland. It was proposed to transfer initially a section of the foundry to Sunderland, and the space vacated would be used for other purposes; machining operations would be carried out eventually at the Sunderland foundry. No redundancy would be caused by the transfer.

C. & G. Insignia Awards in Technology

The Council of the City & Guilds of London Institute confers each year a limited number of special awards to selected persons of distinction in recognition of their achievements in their chosen field. Of seven special awards announced for 1960, one goes to Mr. R. K. JACKSON, for achievements in foundry engineering.

A total of 170 Insignia Awards in Technology has been made since the award was first established, distributed as follow: Chemical and metallurgical industries 40; constructional industries 27; electrical industries 41; mechanical industries 29; and textile industries 33.

International Foundry Congress

For the 27th International Foundry Congress, to be held in Zurich from September 19 to 24, brief details of the provisional programme have already been announced in the JOURNAL (October 29, p. 376). Further information has now been received from the headquarters of the Congress and what follows is the complete programme.

General Programme

Sunday, September 18

2 p.m. to 6.30 p.m.—Registration of delegates at the Congress office (Congress Building, Entrance K, Claridenstrasse).

Monday, September 19

9.45 a.m.—Official opening ceremony. 3 p.m. to 5.45 p.m.—Technical sessions. 8.0 p.m.—Banquet for official delegates by special invitation.

Tuesday, September 20

8.30 a.m. to 6 p.m.—Meetings of the International Committee groups. All-day works visits for delegates, or whole-day joint excursion with their ladies to the Rigi and Lucerne, or whole-day trip to Sustenpass *via* Brunig to Lucerne, or flight over the Swiss Alps, lasting about five hours.

Wednesday, September 21

9 p.m. to 12.45 p.m. and 3 p.m. to 4.45 p.m.—Technical sessions. 7.30 p.m.—Banquet, entertainment and ball.

Thursday, September 22

For all Congress members, whole-day excursion to Lake of Lucerne, departing Zurich main station at 9.45 a.m. and arriving back at Zurich at 6 p.m.

Friday, September 23

9 a.m. to 11.45 a.m.—Technical sessions, also 9 a.m.—meeting of International Committee of Foundry Technical Associations. A whole-day visit has also been arranged for the delegates and their ladies to (*a*) St. Gall and Pestalozzi-Village or (*b*) whole-day excursion to Schaffhausen and the Falls of the Rhine. In the afternoon of this day, works visits have been arranged for the delegates. 7.30 p.m.—Reception of the delegates by the authorities of Zurich.

Saturday, September 24

10 a.m.—Official closing ceremony and presentation of the Award of Honour of the International Committee.

Ladies' Programme

A special series of excursions has been arranged for the ladies, with a tour around Zurich, excursion to Konigsfelden, Bad Schinznach, Bally Museum or Wildegg Castle. Visits for the ladies only have also been arranged to the following: Rietberg Museum, Kunsthaus Zurich (art gallery), Schweizerisches Landesmuseum, Lindt & Sprungli's chocolate factory and Jelmoli, Limited (departmental store). Further, on Wednesday, September 21, there will a lunch and fashion parade by special invitation at 12 noon in the Congress building.

Post-Congress Tours

Post-Congress tours, lasting three days, have also been arranged. These begin and end in Zurich and will show three characteristic sections of Switzerland. No further visits to foundries or machine works will take place.

Tour No. 1

Commencing Sunday, September 25, the party will leave Zurich at 10.20 a.m. by train arriving at St. Moritz at about 3 p.m., lunch being served *en route*. The remainder of the afternoon and evening is free but guides accompanying Congress members will advise regarding the various excursions that can be made (*e.g.*, visit to the Museum of the famous painter, Segantini); night at St. Moritz.

On Monday, the party will leave by coach at 10 a.m. for Lugano, and at 4 p.m. there will be an excursion by motor boat on the Lake of Lugano, stopping in Morcote to visit the church. In the evening, optional visit to a typical Tessin Grotto; night in Lugano. On Tuesday, an excursion has been arranged to Monte Bre, near Lugano, leaving Lugano at 1.10 p.m. and arriving back in Zurich at 4.15 p.m.

Tour No. 2

Sunday, September 25.—Departure from Zurich at 8.53 a.m. by train to Goschenen and motor drive over Susten Pass to Innertkirchen, where a visit will be paid to the Oberhasli power station; night at Interlaken. On Monday, travel *via* Grindelwald to the Jungfraujoch, with lunch in Berghaus. Return *via* Wengen, Interlaken to Berne with evening free; night in Berne. On Tuesday, a two-hour sightseeing tour of Berne has been arranged, returning from Berne at 2.27 and arriving back in Zurich at 3.53 p.m.

Tour No. 3

Sunday, September 25.—Departure from Zurich by train at 9.27 a.m. *via* Berne to Spiez where lunch will be taken by the Lake of Thun. The journey will be continued by train through the Bernese Oberland to Montreux and hotel accommodation in Montreux has been arranged. On Monday, there will be a day excursion by car to the Gruyere district with return *via* Gstaad and Chateau d'Oex; night in Montreux. On Tuesday, a visit will be paid to the Castle of Chillon near Montreux; return by train past the Lakes of Neuchatel and Biel, arriving in Zurich at 3.10 p.m.

Those wishing to participate in the Congress are requested to send in their applications by June 15 at the latest to their local foundrymen's organization (for UK participants reservations should be made with the secretary of the Institute of British Foundrymen, 14, Pall Mall, London, S.W.1). Registration fees for Congress participation are about £16 10s. for the gentlemen and about £8 5s. for their ladies. For visits to works, excursions, sightseeing and for the post-Congress tours supplementary fees will be required. For further information, readers should write to their local foundrymen's organization, or to the International Foundry Congress 1960, Postfach HB 2815, Zurich, 23, Switzerland.

Bid to Increase UK Trade in France

A drive to increase UK exports to France is being organized by the British Chamber of Commerce in Paris. A commission on Anglo-French trade development has been set up and the chamber announces the preparation of a simplified check list to tell British exporters about the administrative formalities they have to undergo to do business in France. An additional sub-committee has also been formed to deal with commercial publicity.

British exports to France last year increased by £9,000,000 to £81,000,000 and 75 per cent. of this total comprised manufactured goods. The total value of office machinery exported was £1,500,000, machine tools were worth £2,700,000, textile machinery, £2,300,000, excavating machinery, £700,000, and electronic and radio equipment, £950,000.

MODERN MACHINE TOOLS, LIMITED—Mr. Eric Greenwood, general manager of the company and of Precision Machinery Services, Limited, has been elected a director of both companies.

British Standards Institution

The technical committee of the British Standards Institution dealing with cast iron has been informed that the sub-committees concerned with grey iron, malleable, and s.-g. iron have now put forward recommendations for their respective materials for inclusion in the revision of B.S.10: "Flanges and Bolting for Pipes, Valves and Fittings." These recommendations, based on research work carried out by the British Cast Iron Research Association, aim to extend the range of temperatures beyond those formerly adopted as the permissible maximum. Acceptance of these recommendations might therefore become general in steam engineering practice.

New Standards

New British Standards concerned with uses of iron castings include:—

B.S.3030 : 1959/60 : School Furniture. In this standard the specified materials for metal components include grey cast-iron conforming to B.S.1452 and malleable iron to B.S.309 and 310. Other sections of the standard will deal with particular types of furniture. (Price 7s. 6d.)

B.S.3161 : 1960 : Process Vessels for the Chemical Industry. In this is laid down the standard sizes for several kinds of process vessels. It makes the point that fabricated vessels made from steel plate are the modern tendency, and that the cost of dies for pressing being a major charge in manufacture, it is desirable to reduce the number of different sizes. Although the foundry is not so restricted, nevertheless, the standard recommends that the cast vessels should follow the dimensions wherever possible for the sake of maximum interchangeability. (Price 7s. 6d. net.)

B.S.3178 : Playground Equipment for Parks. Part 2B of this standard deals with special requirements for children's slides and specifies malleable iron or "Cast iron of adequate strength" for the pedestals, stair treads and chute sides and base (price 6s. 0d. net). Part 3A gives a similar specification for the cast-iron clamps, clips and other fittings in pendulum see-saws.

B.S.3237 : Rolling Stock for Mineral Haulage in Mines. Light and medium rolling stock up to 60 cub. ft. employing fixed or loose wheels are dealt with, the only cast-iron components being the axle pedestals for which grey iron of grade 14 or 17, B.S.1452, is specified as an alternative to cast carbon steel. (Price 15s. 0d. net.)

Revised Standards

Piston-ring Materials : A British standard to revise or replace B.S.5004 : 1927 will specify the materials, mechanical requirements and sampling and test procedure for four grades of cast ferrous piston-ring material. An appendix will make recommendations concerning chemical composition and casting procedure. The present standard is one of the series on automobile material and parts and is entitled "Cast-iron piston-ring pots (sand and chill cast) for automobiles."

Rainwater Goods : Work has started on the revision of B.S.460 and 1205 : 1948, the combined standards which deal with cast-iron rainwater goods. It is proposed to incorporate in B.S.460 the same provisions for varying sockets as have been included in B.S.416. The thickness of rainwater pipes will be $\frac{1}{4}$-in. only, with a cross reference to B.S.416 for thick-walled pipes.

Cmndr. S. DICKINSON, formerly head of the department of engineering at Wakefield Technical College, has been appointed adviser on technical education to the Federal Government of Nigeria.

NUMAS Annual Report

The annual report of the National Union of Manufacturers Advisory Service states that perhaps the most convincing proof of the success of the organization is the economic test of demand and, viewed in this light, the achievement of an income of £65,000, or nearly double that recorded two years ago, is tangible evidence of the value which the smaller firms place upon the services of NUMAS.

The purposes for which NUMAS was set up were to enable the smaller firms to have access to professional advice of a high standard principally on matters affecting their productivity and profitability. The importance of smaller firms in the context of British industry has always been an article of faith of the National Union of Manufacturers which has stood four-square as the defender of their rightful interests by vigilant attention to fiscal, economic and legislative issues of the day and by assisting them in their individual and personal problems. NUMAS has provided a logical extension of these facilities in the all-important field of management and production organization. In this way it is making a contribution not only to the well-being of the individual firms and the 2,000,000 or so people whom they employ, but to the overall national economy. In relation to the 40,000 smaller firms its impact so far is small but individual achievements in assisting managements to achieve substantial increases in productivity, in management efficiency and in profitability are indications of the latent possibilities.

As the service is becoming more widely known, not only for what it sets out to do but for its achievements, the volume of enquiries is increasing and it would seem that for a long time to come its development is likely to depend more upon ability to recruit the necessary staff than upon the level of demand.

The report expresses the appreciation of the board for the valuable contribution made by Mr. L. A. W. Jenkins who was one of the founder directors but who found it necessary to resign last April due to the pressure of other commitments. A warm welcome is extended to Mr. Morton Oliphant, T.D., O.B.E., president of the National Union, who was appointed to the board last July, and to Mr. G. A. Hutcheson, who joined the executive staff and was appointed to the board in January of this year.

Die-casting Exposition and Congress

In conjunction with the First National Die Casting Exposition and Congress, to be held in the Detroit Artillery Armory, West 8 Mile Road, Detroit, USA from November 8 to 11, the Society of Die Casting Engineers has arranged a technical congress which will include eight separate sessions on the four days of the Exposition. Each of the sessions will consist of three technical papers and/or discussions of the subject involved.

On the first day, Tuesday, November 8, the morning session will be devoted to the subject of "Die Design", and in the afternoon to "Die Building". "Metallurgical Developments" and "What's Ahead in Die-casting" are the subjects scheduled for the Wednesday, and "Competition to Die-casting" and "Cost and Profit" will be discussed on the next day. For the final session on the Friday, the subjects will be "Quality Control" and "Vacuum Die-casting".

Notes from the Branches

South Africa

The lecturer at the March meeting in Johannesburg of the South African branch of the Institute of British Foundrymen was Mr. H. Steinhardt, who dealt with the development in the South African non-ferrous metal industry, with particular reference to the production of copper-wire bars and shapes from virgin and refined materials. He also discussed the production of copper-base alloys in the United States and South Africa. A brief history was given of the manufacture and uses of copper, followed by geographic details of deposits. Chile, USA, the Rhodesias, the Belgian Congo, South Africa, Canada, Peru, etc., the author said were producing approximately 90 to 95 per cent. of world consumption.

Smelting Process

The smelting process is carried out mainly in reverberatory furnaces heated either with pulverized coal, natural gas or fuel oil. From the reverberatory furnaces are obtained matte, slag and flue gas. The matte consists mainly of sulphates of copper and iron and contains from 20 to 80 per cent. copper; melting temperature is between 1,000 and 1,200 deg. C.

From the matte, metallic copper is produced in converters. The air blown through the molten matte combines with the sulphur to SO_2 and the iron is oxidized and slagged off. The remaining copper is called *blister copper* and has an average copper content of 98 to 99 per cent. The blister copper is transferred into receiving furnaces and cast either into cakes of 350 to 400 lb. weight for direct use or into anodes for refining. The two types of refining copper in world use are fire refining and electrolytic refining.

Refining-furnace bottoms consist mostly of acid silica bricks, though some American refineries use magnesite or a basic monolithic bottom constructed by sintering of layers of a granular basic material, consisting mainly of lime and magnesia. The side walls are chiefly made of silica bricks lined with magnesite, or magnesite bricks or other basic materials. The furnace roof is constructed of silica bricks in a sprung-arch shape.

Refining Materials

Considering the fact that most copper scrap used for electrical purposes (*e.g.*, overhead wires for power transmission and telephone lines, copper-wire in various types of cable, further generators, electromotors), consists of electrolytic copper of approximately 99.9 per cent. Cu, it is reasonable to conclude that this material if properly refined and re-cast into copper wire-bars, shapes or ingots, should be equal in purity and properties to virgin-copper cathodes which have also to be re-cast in furnaces into the aforementioned shapes.

Certain types of copper scrap which are tinned, leaded, soldered or arsenical and cadmium copper scrap cannot be used for refining to high-conductivity copper, as a very small percentage of other elements would considerably influence the electrical properties. They can, however, be successfuly refined to some other copper specifications where no electrical conductivity is specified.

Cadmium Copper

Cadmium copper scrap mainly deriving from overhead lines (trolley wire, pantograph parts), should either be used for re-conditioning to cadmium-copper bars for rolling or extrusion or the cadmium content which oxidizes very quickly should be eliminated by oxidizing treatment.

Arsenical Copper

Arsenical copper scrap, as obtained from boiler stays and plates, if not re-used direct for arsenical copper shapes, etc., has to be treated with certain chemicals which have a high affinity to arsenic; their compounds deriving from these processes which rise to the surface of the bath are periodically skimmed off until all or most of the arsenic has been eliminated. The author then described the fire refining and electrolytic-refining processes and said that most of the virgin copper used derives from the latter process.

Reclamation of Copper Millscale

To obtain additional quantities of copper for castings or ingot making the reclamation of copper millscale is carried out in the author's works. The material is treated in furnaces particularly designed for this type of work and metallic copper of approximately 99.9 per cent. is obtained.

Commercial Grades of Copper

Reference was made to the most frequently used types of commercial copper such as electrolytic cathode copper; electrolytic copper wire-bars, slabs, billets and ingots; fire-refined copper; cadmium, deoxidized, phosphor, and beryllium copper.

Copper-base Alloys

Copper-base alloys, said the author, were superior to pure copper for most engineering purposes where strength and hardness combined with good mechanical properties, machinability and the highest corrosion-resistance were required. In giving an overall picture of those most used he mentioned the Alpha-Beta brasses which group he said was preferred for castings or hot-working (extrusion, hot-pressings, stampings, etc.). The Alpha-Beta brasses contain more than approximately 37 per cent. zinc, the balance being copper, frequently with an addition of lead (up to 3 per cent.) and allowing for a tin content of up to $\frac{1}{2}$ or 1 per cent.

In the next section of the paper, the author discussed leaded bronzes, phosphor-bronzes and gunmetal; Monel metal and manganese/aluminium bronzes.

The lecture concluded with brief reference to the use of copper in iron and steel. Copper, Mr. Steinhardt said, has an important effect as a graphitizing element on grey cast, grey-mottled and white iron (sand- or chill-castings) and steel. In grey cast-iron an addition of up to 3 per cent. copper increases the wearing resistance and capacity of elastic deformation. The introduction of approximately 1.5 per cent. copper and reduction of the silicon content in chilled grey cast-iron increases the wear resistance of the chilled surface. Finally, he said, that by the addition of approximately 2 per cent. copper to chilled hard steels, the wear resistance is considerably increased, *e.g.*, for balls used for ball mills, rail points, etc. Further copper increases the fluidity of carbon steels and a number of thin and intricate castings, *e.g.*, cylinder blocks, heads, etc., are easier to cast from steels with copper addition. Some of the large American car manufacturers are using crankshafts, hub and brakedrum castings from copper-silicon steels instead of forgings. After presentation of the paper, a colour film of copper production in the author's works was shown.

Mr. K. H. Coombs, the branch president, called on Mr. D. Gordon Jones to open the discussion, and, at the conclusion of a lively debate, a hearty vote of thanks was proposed by Mr. R. C. Cross.

East Midlands

Guests came from as far afield as Sheffield and London to be present at the annual dinner/dance of the East Midlands branch of the Institute. The function was held at the Bell Hotel, Leicester, on May 6. The event was a little less formal than usual, and the

Photographs taken at the annual dinner/dance of the East Midlands branch held at the Bell Hotel, Leicester. Top (left to right) Mr. G. R. Shotton, national senior vice-president, Mrs. Shotton, Mr. B. N. S. Perry, branch president, and Mrs. Perry. Bottom (left to right) Mr. G. Lambert, national secretary, Mrs. Lambert, Mrs. Brown, Mr. G. Brown, syllabus secretary, Mrs. Lamb and Mr. G. Lamb, branch secretary.

after-dinner speeches were cut both in number and length. Among the gathering of 176 people were two of the branch's four past-national presidents, Mr. S. H. Russell and Mr. J. W. Gardom, who were accompanied by their ladies.

Proposing a toast to "The Guests," Mr. B. N. S. Perry, of Geo. Perry & Sons, Leicester (patternmakers), president of the East Midlands branch, jocularly confessed to the gathering that it was rather frightening for a patternmaker to be faced with so many foundrymen.

Mr. Perry continued by expressing regret that the Institute's national president, Mr. C. H. Wilson, was unable to be present at the dinner, as he was abroad on business for his firm, Stanton Ironworks, but expressed the branch's pleasure at having Mr. G. R. Shotton, national senior vice-president, and Mrs. Shotton, present instead. "We wish him a happy and successful time next year," concluded Mr. Perry.

Mr. Shotton replied briefly but humorously on behalf of the guests, and the evening continued with dancing.

It was the first time for four years that the branch had held their dinner in Leicester.

Wales and Monmouth

A highly successful annual dinner/dance was held by the Wales and Monmouth branch at the Royal Hotel, Cardiff, on April 8, Mr. R. S. Turner (branch president) presided, and the official guests included Mr. G. R. Shotton (national senior vice-president), who deputised for the national president (Mr. C. H. Wilson), who was abroad on a tour of Canada and Australia.

The only toast of the evening was to "the Wales and Monmouth Branch," proposed by Mr. Shotton, to which Mr. R. S. Turner, responded. At the end of the speeches, Mr. L. J. Duddridge, last year's branch president, received his branch past-president's badge, to warm applause. Members and guests were entertained by a male voice choir of the calibre which only Wales could produce, and the remainder of the evening was devoted to dancing. The organization was well up to the high standard which Mr. A. S. Wall, the branch secretary, has achieved in previous years.

Lincolnshire

The Lincolnshire branch held its annual dinner in the Great Northern Hotel, Lincoln, the branch president, Councillor A. H. Chatteris, presiding. The toast to the Institute was proposed by the Mayor of Lincoln, Councillor F. W. G. Todd, and Mr. G. R. Shotton, national senior vice-president responded, the "Lincolnshire Branch" was proposed by Councillor D. Petchell and replied to by Councillor Chatteris. Mr. C. Anderson, president-elect proposed a toast "The Guests" to which the City Sheriff of Lincoln, Mr. F. Hunt replied.

Natal Section

A paper entitled "The Right Metal for the Job" was presented by Mr. Bird to the March meeting of the Natal section, held in Durban. The paper dealt exclusively with non-ferrous metals and alloys and provoked considerable interest and a lively discussion, questions being most ably dealt with by Mr. Bird. At the conclusion of the meeting, a vote of thanks proposed to the lecturer by Mr. Roberts was heartily accorded by all present.

Australia (Victoria)

The first general meeting this year of the Australia (Victoria) branch took the form of a film evening, held on March 16 in the Metallurgy School of the Royal Melbourne Technical College. Three films were shown: the first entitled "Exothermic Feeding of Castings" was followed by "Spheroidal-graphite Cast Iron" and the last one was of general interest. Members then discussed the films and after a light supper the meeting closed.

THE IBF COVENTRY AND DISTRICT SECTION has arranged a works visit to Ford's Thames Foundry, Dagenham, Essex, on May 25.

IEA Exhibition

The Instruments, Electronics and Automation Exhibition is to be held next week at Olympia, London, from May 23 to 28. Amongst the many displays which will be of particular interest to founders are those briefly described below.

BRITISH ROTOTHERM COMPANY, LIMITED (*Q*729): will be exhibiting a comprehensive range of dial thermometers, recorders and controllers.

RESEARCH & CONTROL INSTRUMENTS, LIMITED (*D*164): will show a range of new types of miniature thermocouple wires, and stage a continuous demonstration of industrial electronic weighing.

FOXBORO-YOXALL, LIMITED (*E*202): will show a completely new range of transmitters, recorders and controllers for flow, pressure, temperature, etc., and a representative selection of their pneumatic-control equipment.

ETHER, LIMITED, AND ELECTRO METHODS, LIMITED (*E*205): will feature a complete range of temeprature measuring and control instruments, including both millivolt and potentiometric types. Temperature indicators and recorders will also be displayed.

WALKER CROSWELLER & COMPANY, LIMITED (*Q*700): The main display will consist of the range of Arkon model-1600 pressure and vacuum recorders, and model-1601 gas-flow recorders. Remote reading versions of these instruments will also be on view.

CAMBRIDGE INSTRUMENT COMPANY, LIMITED (*Stand F*259): Amongst a wide range of recorders and controllers on show will be three different types of industrial resistance-thermometer, and a pocket-size self-contained temperature recorder for use in confined spaces.

MINERVA DETECTOR COMPANY, LIMITED (*G*309): This stand will be equipped with three complete installations of the Minerva fire-detection system, illustrating its application to the protection of buildings, and of individual items of industrial and technical equipment.

KELVIN & HUGHES (INDUSTRIAL), LIMITED (*F*257): will exhibit a comprehensive range of temperature controllers, all incorporating the galvanometer type of measuring system, and an ultrasonic flaw detector designed for routine inspection within production units.

WEST INSTRUMENT, LIMITED (*H*354): will display the Veri-Tell indicating pyrometers and resistance thermometers, including portable and multi-point indicators, and a complete range of pyrometer accessories for all makes of temperature indicators, controllers and recorders.

DEPARTMENT OF SCIENTIFIC & INDUSTRIAL RESEARCH (*E*214): will display 25 new instruments and measuring techniques which have been developed in its laboratories and at research associations. Particularly interesting is a thermocouple output simulator which provides a simple method of calibrating oscilloscopes for displaying the voltage outputs of thermocouples, by indicating temperatures directly on the range dials.

CFA Annual General Meeting

At the annual general meeting of the Council of Ironfoundry Associations, held in London, last month, Mr. M. J. Glenny was re-elected as chairman, vice-chairmen, Mr. D. Graham Bisset, Mr. F. D. Ley and Mr. H. V. Shelton were also re-elected. Those elected or re-elected to the executive committee were Mr. H. A. Bonney, Mr. M. M. Hallett, Mr. R. L. Handley, Mr. C. G. Mackie, Mr. N. P. Newman, Mr. S. N. Turner, and Mr. A. E. Pearce (co-opted member).

Law Cases

Importance of the Man at the Bottom

Damages of £400 were awarded against Firth Vickers Stainless Steels, Limited, at Sheffield County Court, to Mr. William Heathcote, a fitter who was injured in a fall from a ladder in the motor house at the works. Special damages were agreed at £110.

Heathcote said he had gone with his mate into the motor house to remove a "monkey" from a girder and had instructed the mate to hold the ladder at the bottom. He passed one end of the rope to his mate and was going to step higher up the ladder to lean over the girder when he fell. Judge Ernest Ould said that on any view of the matter, Heathcote's injuries had lasted for 18 months in their effect and might or might not have further effects. He added, "This could not have happened, in my opinion, if the man at the foot of the ladder had been doing his job properly. People are only human, and from time to time, perhaps momentarily, whatever job they are doing their attention strays."

MR. ALFRED WALKER CARTWRIGHT (67), a crane driver who fell from a ladder made slippery by oil and broke a wrist and ankle, was awarded damages of £1,200 with costs at Durham Assizes against Darlington & Simpson Rolling Mills, Limited, for whom he was working when the accident happened in 1956. A 21-day stay of execution was granted by the judge.

FINE OF £25 was imposed by Ilkeston (Derbyshire) Magistrates on the Stanton Ironworks Company, Limited, for having a dangerous part of machinery insecurely fenced. It was stated that a labourer's arm was trapped while he was cleaning a moving conveyor belt. The company, which admitted the offence, was said to have a high safety record. Notices were posted prohibiting the cleaning of conveyor belts while in motion.

Refresher Course in Foundry Practice

The Metallurgy Department of the Battersea College of Technology, London, S.W.11, announces that a refresher course on "Developments in Foundry Practice" will be held during the period July 19 to 22. The lectures will be given by a panel of visiting specialists from the foundry industry.

The course has been designed to survey the progress and developments in both processes and equipment on a wide front, and to indicate the possible significance of these developments. Lectures will cover the following topics:—"Technological and Managerial Developments in the Foundry Industry"; "Developments in Permanent Mould Practice"; "Developments in Sand-mould Practice"; "Precision Casting To-day"; "Foundry Equipment" and "Future possibilities in the Foundry."

There will be ample time for discussion of each topic and it is hoped to arrange some suitable visits to foundries. The fee for the course is £12 12s., inclusive of luncheon, morning and afternoon refreshment, and visits. Enrolment forms and further information may be obtained from the secretary (metallurgy courses), Battersea College of Technology, London, S.W.11.

MR. FRANK EXLEY, who has died at the age of 74 after a long illness, was principal of Frank Exley, Limited, truck and trolley manufacturers, Cambridge Works, Bradford. The company was founded by his father more than a century ago.

News in Brief

SOLARTRON-JOHN BROWN AUTOMATION, LIMITED, has been registered with nominal capital of £100,000 in £1 shares (50,000 "A" ordinary and 50,000 ordinary).

WHEN THE Compressed Air & Hydraulics Exhibition closed at Olympia, London, on April 29, 28,966 visitors had passed through the turnstiles, of which one-fifth were from abroad.

FORTY-FIVE SALES REPRESENTATIVES of W. & T. Avery, Limited, Smethwick, recently spent a weekend in San Remo, Italy, the company meeting the cost, in recognition of their achievements in a sales competition.

AT THE UNITED NATIONS conference on tin in New York this month, the Federation of Malaya will be represented by a strong delegation, headed by Dato Nik Kamil, Malayan Ambassador to the USA.

A FOUNDRY COURSE for non-foundry workers is to be held at the Poplar Technical College for two weeks during July. Full particulars may be obtained from the principal of the College, High Street, London, E.14.

APPROXIMATELY the whole of the northern part of the premises of Richard Duckering, Limited, iron-founders, Rosemary Lane, Lincoln, have been secured for a proposed YMCA hostel and club to cost £60,000.

BRITISH POLAR ENGINES, LIMITED, Glasgow, in a period of two months, has received orders worth about £400,000. The orders include a new type of diesel engine which is being supplied for a twin-screw "drive-on, drive-off" ferry being built in Australia.

CHAS PAGE & COMPANY, LIMITED, 52, Grosvenor Gardens, London, SW1, have been appointed by Marine Oil Refiners of Africa, Limited, as sole UK importers and general European agents for the drying oil known as Marinol K and its derivatives.

THE OPENING CEREMONY of the Yorkshire Electricity Board's new service centre at Wath, South Yorkshire, was performed by Councillor W. Cutts, chairman of Wath Urban Council, on May 5. The centre is housed in a completely new building in Sandygate.

STEEL PRODUCTION in Western Germany this year will probably reach 34,000,000 *tonnes*, according to the Bulletin for German Industry. It quoted Dr. H. G. Sohl, president of the Iron and Steel Association, as saying that the figure would be 15 per cent. up on last year.

OFFICES at Buckingham House, 50, The Terrace, Torquay, and 33, George Street, Dumfries, are being opened by United Dominions Trust on May 23 and 30 respectively. Also on May 30, UDT's branch office in Carlisle will move to Barclays Bank Chambers, 1a, Devonshire Street, Carlisle.

A GERMAN MINERALOGIST from the Salzgitter State Works, West Germany, reached Mendoza, Argentina, recently to study the production capacity of the lead, copper and manganese deposits of the Province. There is a possibility that mineral treatment plants with investments of German capital will be installed.

ALLIED IRONFOUNDERS, LIMITED, has entered the refrigerator market with their latest product, the new "Leisure" freezer refrigerator. It has a capacity of 5½ cub. ft. and is operated by a Tecunseh condensing unit of 1/10th h.p., claimed to be silent in operation and free from radio and television interference; shelf area is 11 sq. ft.

WILLIAM PARK AND COMPANY, LIMITED, Clarington Forge, Ince, near Wigan, have made an offer for the purchase of 9.66 acres of land adjoining their present works, at a price of £4,250. The land is part of a 31-acre site acquired by the Planning and Development Committee of Lancashire County Council, which has recommended acceptance.

THE EAST MIDLANDS GAS BOARD are to build new headquarters in Leicester to replace existing administrative accommodation now carried on in four separate offices in Leicester and Northampton. The Leicester Town Planning Committee have given permission for a four-storey building on an extensive site between Regents Road and Lancaster Road.

THERE WERE 1,000 GUESTS at the annual dance of the Thorncliffe Social and Recreational Association of Newton Chambers & Company, Limited, held at the Cutlers' Hall, Sheffield, on May 6. For the benefit of those who had been unable to watch the Royal Wedding in the morning, television was installed in the hall for the evening telerecord show.

DURING THE FIRST QUARTER of 1960, Chile's large copper mines produced 126,039 tons, as against 120,029 tons in the same period of last year. Chuquicamata's output totalled 43,757 tons of electrolytic and 18,878 tons of blister; El Salvador produced 17,492 tons of blister; and El Teniente's output amounted to 23,282 tons of fire-refined and 22,630 tons of blister.

DELEGATIONS AND REPRESENTATIVES from over 45 countries visited the Fuel Efficiency and Power for Industry Exhibition which closed on May 6, at Olympia, London. This figure included visitors from Czechoslovakia, Germany, the Netherlands, Belgium, Kuwait, Burma, Japan, Portugal and the United States of America. Several exhibitors, by special request, arranged visits to their factories.

SOUTH AFRICA exported 13,705 tons of iron ore in February, 1960, as against 19,182 tons in January and 14,414 tons in December, 1959, according to provisional figures issued by the Government Mining Engineer, Johannesburg. In February, Japan took 13,251 tons and Holland 454 tons, while Japan took all the January exports. Japan imported 11,826 tons of the December exports, Germany the remainder.

PARK GATE IRON & STEEL COMPANY, LIMITED, Rotherham, have informed Barnack Rural District Council of plans to dig ironstone and sand in their area at Wothorpe and in the George Farm area. General Refractories, Limited, Sheffield, have also informed the Council of a project to dig sand from the area of George Farm. An application also to take 200 gall. of water per minute from a nearby stream has been passed by the Council to the Welland River Board.

THE INTERNATIONAL PLASTICS EXHIBITION is being held in Oslo this year, from May 19 to 29. Peco Machinery Sales (Westminster), Limited, are showing their fully-automatic 30-MS-30 injection-moulding machine, which has a capacity of 4¼ to 8½ oz. (127 to 240 gm. per shot). This unit is equipped with the Thermax high-capacity plasticising chamber which is claimed to give greater plasticising rates and reduce the cycle time on many moulding operations.

THE KILMARNOCK FIRM of Glenfield & Kennedy, Limited, valve specialists and hydraulic engineers, have concluded a licensing agreement with the German firm of Schmitz & Schulte, as a result of which they will shortly be in a position to supply S. and S. diaphragm valves to the UK and Commonwealth countries from their Scottish works. The S. and S. diaphragm valve is of advanced design and can be applied in almost every industry for controlling the flow of liquids and gases.

BIG DEMAND IN SHEFFIELD for tickets to see the two new colour films of the United Steel Companies, Limited, has resulted in the decision to show the films in that city on two days, June 13 and 14, instead of one. The films are "Stone into Steel," dealing with the Appleby-Frodingham Steel Company's works at Scunthorpe, and "Out of the Forest," concerned with the United Coke & Chemicals Company, Limited, near Sheffield. They are introduced by the chairman of the group, Sir Walter Benton Jones.

NO OBJECTION is to be raised by Derbyshire Planning Committee to a proposal by the Central Electricity Generating Board to run an overhead power-cable carrying 275,000 v. from a point south of Rotherham to a sub-station at Norton Lees, Sheffield, the route being through part of the green belt between Sheffield and Chesterfield. The Committee agreed to the proposal after being told that the cost of overhead lines was £25,000 a mile compared with £350,000 to £400,000 a mile for underground cables.

JOHN DALGLISH & SONS, Glasgow engineers, have been awarded contracts worth £250,000 for synthetic-rubber drying equipment to be used in the first factories of this kind to be erected in Brazil and in Australia. The equipment for Brazil—four three-tier GR-S rubber dryers—is for a refinery near Rio de Janeiro, operated by Petrobras, the State-controlled enterprise. The Australian contract, for two large GR-S dryers for a refinery installation near Melbourne, has been placed by the Standard-Vacuum Oil Company of New York.

KENYA'S TOTAL MINERAL PRODUCTION in 1959 amounted to a record £5,319,355, or £1,200,000 more than in 1958. The higher price paid for copper during the year enabled the copper-producing mines to increase the value of their output by about £75,000, but the rise in the total value of minerals was mainly due to cement and soda ash with increases of £600,000 and £467,000 respectively. Smaller increases were recorded in the value of carbon-dioxide gas, magnesite, mica, refined gold, limestone products, mullite, pumice, vermiculite and refined silver.

Mr. K. J. SAUNDERS, Singapore manager of J. Whyte & Company, Limited, stated recently that Rolls-Royce diesel-engines are being used more and more in various industries in Singapore, Malaya, Borneo, and other areas. The latest generating plant, equipped with a R.R. engine, to be found in Singapore, was recently supplied to the Shell Company, of Singapore, Limited, to provide emergency standby power for their new skyscraper at Collyer Quay. This super-charged eight-cylinder engine, capable of producing 366 hp, drives a generator with an output of 160 kw.

AN INCREASE in South Africa's iron exports last year is indicated by figures for the last nine months of the year showing that iron for export handled by the railways totalled 204,155 tons, as against 14,895 tons in the same period of 1958. Demand from local foundries and factories also went up from 1,945,613 tons to 2,276,575 tons. The amount of manganese destined for export increased by about 80,000 tons to 423,693 tons, and that carried for local consumption increased by 37,000 tons to 370,000 tons. Chrome carried for export totalled 477,385 tons—12,000 tons up on the same period in 1958.

A SYMPOSIUM on the "Protection of Gas Plant and Equipment from Corrosion," to be held on September 22 and 23 at the College of Advanced Technology, Birmingham, has been arranged by the Institution of Gas Engineers and the Society of Chemical Industry—corrosion group, Birmingham and Midlands section. The conference fee for members of the organizing bodies and for bona fide students of universities and technical colleges is £2 2s. and for non-members £3 3s. Full details may be obtained from the symposium secretary, Department of Chemistry, College of Advanced Technology, Gosta Green, Birmingham.

"TEES-SIDE AT MID-CENTURY" is an industrial and economic survey of the area sponsored by North East industrial firms and associations and published on May 5. It is written by Mr. J. W. House and Mr. B. Fullerton of the Department of Geography at King's College in the University of Durham. Information was provided by 179 firms employing two-thirds of the total labour force in the Tees-side manufacturing industry, mainly steel, engineering and chemicals. The post-war years have brought great expansion to the area—since 1945 capital investment in manufacturing industry alone has reached a total of £350,000,000. The survey is published by Macmillan & Company, Limited, St. Martins Street, London, W.C.2.

THE EAST MIDLANDS Gas Consultative Council decided on May 5 to ask the Gas Board to consider introducing an optional two-part tariff for commercial consumers. The Council also discussed the Board's refusal to allow discount on sales in their showrooms. It was reported that a trader at Scunthorpe opposite the gas showroom is offering five per cent. discount for cash. The Board explained that their policy was based on the fact that the profit on the sales of appliances was barely sufficient to meet present-day costs. To give a discount they would have to subsidize sales from the price of gas. The alternative was to increase appliance prices to allow a cash discount. Five per cent. discount would cost £60,000 a year.

IT IS REPORTED by the London Midland Region of British Railways that work has started on a £1,500,000 scheme to remodel completely the marshalling yard at Bescot and will take about two years to complete. At present, the area between Birmingham, Wolverhampton and Walsall is served by a number of marshalling yards of varving size including those at Bushbury, Stechford, Wichnor and Birmingham Exchange, all of which will cease to be used for marshalling when the new Bescot yard commences operation. Another project is the building of a new freight terminal adjacent to the present goods depot at Watford. When completed sundries and full-load traffic which are now dealt with in the area bounded by Harrow, Harpenden and Great Missenden may all be concentrated at Watford.

"ANY INTERRUPTION OF PRODUCTION, particularly when all that is produced can be sold, can make heavy inroads into the profitability of the plants involved," said Mr. S. P. Chambers, chairman of Imperial Chemical Industries, Limited, in a review of the company's 1959 results to the ICI Central Council. He was referring to the recent unofficial strike at the Wilton Works of about 1,000 members of the AEU who disregarded union advice by striking after a chargehand was temporarily demoted for an alleged breach of safety regulations. Mr. Chambers said that his mention of this unconstitutional strike would interpose a "slightly jarring note" but pointed out its effect on production and profit. He added that the question must clearly arise whether the company was justified in future in including in the profit-sharing scheme for any year, those people who by unconstitutional action had reduced the profit which would otherwise be available to all employees. He said a decision had not been reached on the matter but it required consideration. The speech is reported in the latest issue of the works' newspaper.

Publications Received

Sampling of Coal and Coke. Part I: Sampling of Coal, and Part II: Sampling of Coke. Issued by the British Standards Institution, 2, Park Street, London, W.1; price 25s. each part.

This new Standard replaces B.S. 1017:1942: Methods for the Sampling of Coal and Coke, and B.S. 735:1944: Sampling and Analysis of Coal and Coke for performance and Efficiency Tests on Industrial Plants.

There can be very great difference in the variance of increments taken from coals of approximately the same ash content. The 1942 Standard, in allowing a suitable number of increments for the most difficult coals to be sampled to the required standard of accuracy, caused considerable over-sampling of the easier coals. This is now overcome by the introduction of the technique of duplicate sampling, which involves placing alternate increments in two separate bins, analyzing both samples independently and recording the difference between the two results. The Standard stresses the importance of avoiding systematic bias. Automatic samplers are discussed, and the possibility of bias in these. Large increments may be reduced in uniform proportions using a sample divider.

The preparation of the sample for analysis is discussed and apparatus for carrying out the operations is described in an appendix. An improvement on the previous Standard is a table giving the weights of samples corresponding to particle sizes.

Part II refers to coke produced at coke-oven plants and gasworks, although with certain provisos the Standard can be applied to low-temperature coke.

The principles underlying the recommendations of the old Standard still hold good, but new recommendations based on more complete data have been included. Improved sampling techniques and the procedure for duplicate sampling are given; in particular, sampling from conveyors and wagons is much more highly developed.

Screened and unscreened coke are now dealt with separately, and in consequence the number of increments of the former has been decreased and of the latter increased. The moisture content of the coke being the most variable characteristic, it is assumed that a sample satisfying the requirements in respect of this will be perfectly satisfactory in respect of other factors such as ash, calorific value and ultimate analysis.

The new Standard reduces the number of increments necessary in certain cases. Intermittent sampling receives special attention, and a new section gives the procedures for checking the actual accuracy obtained in any particular sampling programme, while statistical tests are dealt with far more thoroughly. Current statistical practice is acknowledged by the reference of accuracies to the 95 per cent. probability level instead of the 99 per cent. level. A useful innovation is an outline guide designed to draw attention to all the points which must be considered when a sampling scheme is to be instituted.

Meehanite Metal Selection Chart. Issued by the International Meehanite Metal Company, Limited, Meerion House, 4, Downside, Epsom, Surrey.

This new Meehanite metal-selection chart has been produced to meet difficulties experienced by many designers and users of castings in selecting the right type of metal for a particular application. Correct metal-selection is usually the determining factor in casting performance and plays a decisive rôle in the economics of castings applications. This particularly applies where the service conditions involve a combination of demands on casting properties. Sometimes, these requirements are incompatible one with another, and it then becomes a question of studying the relative importance of each factor. The information contained in the selection chart under review is based on a careful study of a large number of actual casting service-records garnered over the past 25 years.

The chart takes the form of an assembly of two cards, about 8 by 5 in. rivetted together, with a third sliding between. The outer cards carry explanatory typescript and have two vertical "windows" in line against six headings, *i.e.*, main group, service conditions; application number; casting examples; type of Meehanite recommended, and treatment. In use, it is necessary to set the inner slide against the main group requirement and any one of up to six subdivisions of it, depending on the particular service conditions. For example, under the main group of "wear," there are five service conditions: lubricated wear; abrasive wear; heavy abrasion with shock; wear with development of heat crazing, and erosion from solids carried in liquids. Having thus set the inner slide, lower in the same window, it is then possible to check against a list of typical casting applications and finally, in the bottom window, are then indicated the type of metal and the treatment recommended for it.

The chart contains information useful both to the designer and engineer and has a format—*multo in parva*—which will appeal to them. The reviewer's opinion is that it meets a real need in the foundry industry.

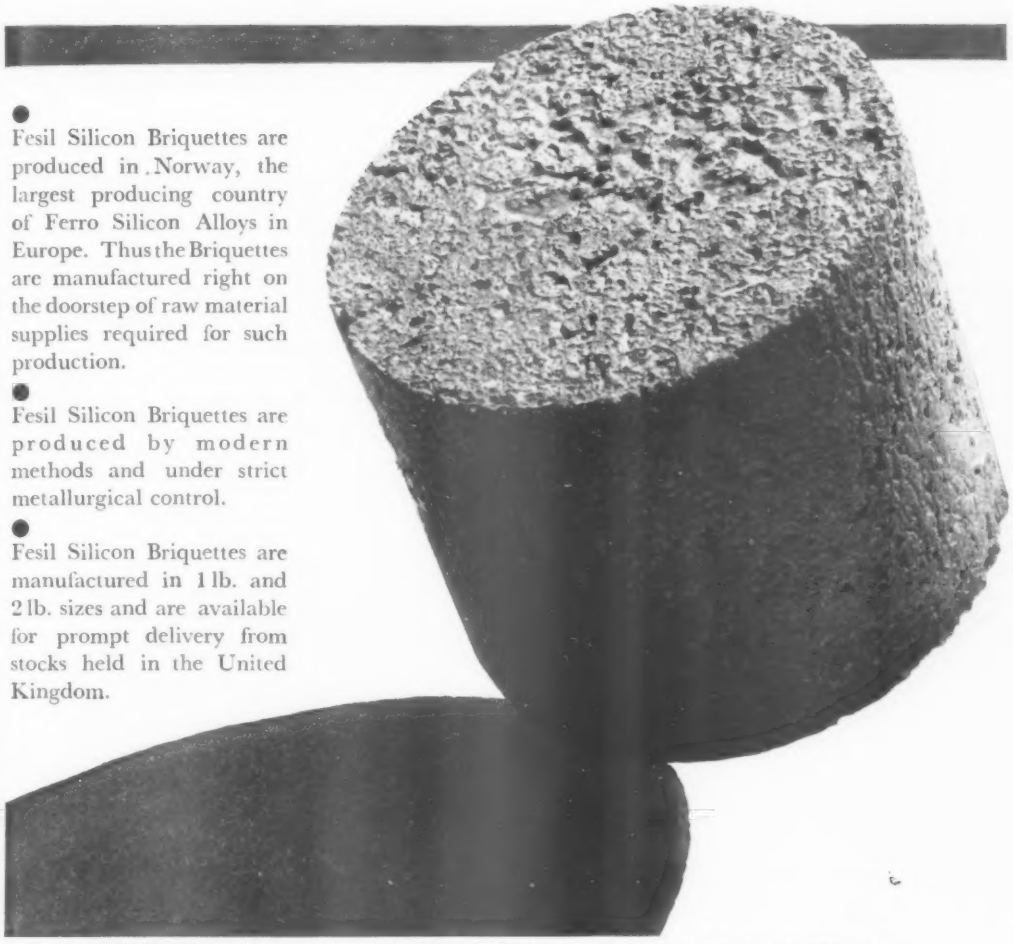
New Catalogues

Sand Mixers. Baker Perkins, Limited, Bedewell Division, Hebburn-on Tyne, have issued a four-page leaflet which describes and illustrates four types of mixers. The first, based on the Archimedean-screw principle, is a continuous muller in five sizes, giving a range of outputs from 15 to 300 tons per hr. A similar, but simplified, mill is shown for tempering and blending backing sand. This machine is made in three sizes with outputs ranging from 20 to 100 tons per hr. Included also in the leaflet is a description of a vertical sand mixer, a new machine for the smaller foundry. Details of its capacities are not included, but these will no doubt be forthcoming in the future. The fourth machine illustrated is the Simplex mixer and here nine capacities are given, ranging from one to 22 cwt.

Self-locking Nuts. An illustrated 16-page brochure containing full details of Nyloc self-locking nuts, including the new stock sizes announced last year, is now available on request from Simmonds Aerocessories Limited, Treforest, Pontypridd, Glamorgan and their stockists. Prior to 1959, the largest standard nuts in the Nyloc range were 2-in. thread diameters; the additional sizes, from 2¼ in. to 4 in., are now available in both full and thin Nyloc types, in British Standard fine, Whitworth, unified coarse and selected-series threads.

Assembly Trays and Storage Bins. Precision Components (Barnet), Limited, 13, Byng Road, Barnet, Herts, have issued a catalogue describing and pricing a line known as Kabi polythene storage bins and bench-assembly trays. The illustrations show that they are of neat design.

FESIL SILICON BRIQUETTES



- Fesil Silicon Briquettes are produced in Norway, the largest producing country of Ferro Silicon Alloys in Europe. Thus the Briquettes are manufactured right on the doorstep of raw material supplies required for such production.
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Personal

Air Marshal SIR GEOFFREY TUTTLE has joined the board of Vickers-Armstrongs (Aircraft), Limited.

Mr. JOHN GRICE, general manager of the Baglan Engineering Company, Limited, Melyn Works, Neath (Glam), has been appointed a director.

Lieut.-Colonel CHARLES GUILLAN, secretary of the Institute of Metals, has been elected an honorary member of the *Société Française de Métallurgie*.

Mr. A. EASTON, production controller for M. Cockburn & Company, Limited, Falkirk, has been elected president of the Forth Valley Junior Chamber of Commerce.

Mr. H. E. JACKSON, executive director (engineering), of Tecalemit, Limited, is on a business tour of Brazil, for the purpose of expanding the company's markets in South America.

Mr. ARTHUR WHITELEY, assistant managing director, Massey-Ferguson (Export), Limited, is retiring from the company on June 10 on reaching his 60th birthday, and on medical advice.

Sir W. HUNGERFORD POLLEN, Mr. R. E. G. WINDSOR, Mr. P. C. WINDSOR, Mr. W. MCCOLL DODDS, and Mr. R. D. FOX have been appointed to the board of the Barrow Haematite Steel Company, Limited.

Mr. GEORGE ELLISON, JNR., a grandson of the founder of the business, has been elected a director of George Ellison, Limited, Perry Barr, Birmingham, and also of Alfred Ellison, Limited, and Tufnol, Limited.

Mr. H. J. H. NETHERSOLE, general manager, traction, of the English Electric Company, Limited, has been appointed a director of the Vulcan Foundry, Limited, and of Robert Stephenson and Hawthorns, Limited.

Admiral Sir NOEL LAURENCE will be the guest of honour at a centenary staff dinner of Hudswell, Clarke & Company, Limited, engineers, Railway Foundry, Leeds, to be held at Queens Hotel, Leeds, on May 20.

Mr. CHARLES R. NEWTON, chief accountant of Cockburns, Limited, Glasgow, has been appointed a director of the subsidiary company Cockburns (Springs), Limited. He will continue as chief accountant of the parent company.

Professor D. G. CHRISTOPHERSON, Professor of Applied Science at the Imperial College of Science and Technology, University of London, has been appointed Warden of the Durham Colleges, on the retirement of Sir JAMES DUFF.

Mr. CHARLES H. COBB, who has been foreman in the heat-treatment shop of Edward Pryor & Sons, Limited, Broom Street, Sheffield, for nearly 17 years, received a presentation from the managing director, Mr. G. R. Pryor, on his retirement on May 6.

Mr. W. E. WARD, director and general manager of the Consett Iron Company, Limited, has been elected chairman of the Wear District Advisory Committee of the Northern Regional Board for Industry. Mr. J. W. LOUGHRAM, district secretary of the AEU, has been elected vice-chairman.

Mr. H. H. UTLEY, a director and general manager of the Davy & United Roll Foundry, Limited, Sheffield, since 1957, has been appointed managing director in succession to Mr. M. A. FIENNES, who was previously both chairman and managing director, and remains chairman of the firm.

Mr. A. J. PEECH, deputy chairman and general managing director of the United Steel Companies, Limited, has been appointed a part-time member of the Iron and Steel board with effect from June 1. Mr. A. H. WILSON, deputy chairman and managing director in charge of research and development, Courtaulds, Limited, is to be an additional part-time member.

Mr. ARTHUR SYKES, technical consultant to the David Brown Group, has been awarded the first gold medal of the British Gear Manufacturers' Association, in recognition of his outstanding work on behalf of the Association. Mr. Sykes, who is 72, first joined the company in 1905, and prior to his present appointment had successively served as chief engineer, works manager, and engineering controller.

Mr. J. L. S. STEEL has been elected to the board and appointed deputy-chairman of Triplex Holdings, Limited. Mr. Steel, who is 60, recently retired from the board of Imperial Chemical Industries, Limited, after more than 37 years with that company. For some years he was responsible for ICI's economic planning, with particular interest in the European Common Market and Free Trade Area.

Mr. PETER HAWKSFIELD has been elected president of the Coal Merchants' Federation of Great Britain in succession to Mr. EDWARD LEE. Mr. W. T. MAINWARING-HUGHES becomes senior vice-president, and Mr. PETER BREWIS, junior vice-president. Mr. Hawksfield is managing director of the Associated Coal and Wharf Companies, and chairman of the south-eastern regional committee of the Coal Utilisation Council.

Following the acquisition of Almin, Limited, by Imperial Chemical Industries, Limited, and the Aluminium Company of America (Alcoa), the board has been reconstituted as follow:—Dr. J. TAYLOR (chairman), Mr. DUBOSE AVERY, Mr. W. BRINING, Mr. J. M. GRAHAM, Mr. F. RESCH, Mr. F. B. H. VILLIERS and Mr. S. W. WEYSOM. Dr. Taylor is a director of ICI. He is also chairman of Imperial Aluminium Company, Limited, and Yorkshire Imperial Metals, Limited, other large associates of ICI in the non-ferrous metals field.

Sir EDWIN HERBERT has been appointed president of the Electrical Development Association for 1960/61, in succession to Sir JOSIAH ECCLES. Sir Edwin, a past-president of the Law Society, is senior partner of Sydney Morse & Company, solicitors. LORD MORRISON OF LAMBETH has been appointed a vice-president of the Association for 1960/63, and Captain J. M. DONALDSON, Sir HARRY RAILING and Mr. VICTOR W. DALE have been re-appointed vice-presidents for the same period. Mr. D. B. IRVING, chairman of the London Electricity Board, has been elected chairman of the Council of the Association for the current year in succession to Mr. T. E. DANIEL. Mr. R. R. B. BROWN becomes vice-chairman of the Council.

After 52 years' continuous service with companies in the Allied Ironfounders group, 85-year-old Mr. ALEXANDER CUTHELL, designer of period fireplaces, has retired. Mr. Cuthell, who started work at the age of 13 in the drawing office of the Carron Company, later joined the Laurieston Iron Works (McDowall Steven & Company, Limited) as a draughtsman, and subsequently became works manager. In 1934, when the firm joined the Allied Ironfounders group, he transferred to the drawing office of Falkirk Iron Works, where his skill in draughtsmanship resulted in his devoting himself to the design of period fireplaces for another Allied company, H. E. Hoole & Company. Mr. Cuthell eventually became one of the most notable designers in this field.

LSR 81 Grinder at work on a heavy casting

COMPRESSED AIR for the FOUNDRY

Atlas Copco puts compressed air to work for industries of every class—light, medium and heavy. For foundry work there are Atlas Copco rammers, chipping hammers and grinders carefully balanced to reduce operator fatigue and ensure the best possible results. For example, rammers are designed to "walk" with a minimum of guidance, allowing the operators to give all their attention to tamping.

Grinders—for swifter, easier operation

Atlas Copco heavy duty grinders are easier, less tiring to use. They combine maximum power with minimum size and weight and are designed for the quietest possible operation. Special safety governors ensure constant speeds regardless of varying loads. These grinders open the way to increased output; with Atlas Copco R-type chipping hammers they form a range of robust, reliable tools for all types of fettling and dressing operations.

Air hoists—accurate to a fraction !

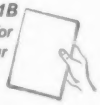
For ultra-sensitive control, Atlas Copco air hoists are in a class of their own. Their infinitely variable speeds permit loads to be placed with ease and accuracy. The air motors are fully protected and the hoist can be operated with complete safety in any atmosphere—hot, dusty, damp, explosive or corrosive.

Sales and service in ninety countries

With companies or agents in ninety countries, Atlas Copco is the largest organisation in the world specialising solely in compressed air equipment. Products include stationary compressors from (2.5 to 20,000 c.f.m.) ·08 to 566m³/m portable compressors, air tools, rock drills, loaders and paint-spraying equipment. Wherever you are, the international Atlas Copco group offers expert advice and provides a complete after-sales service.

WRITE FOR CATALOGUE E811B

This catalogue presents a selection of Atlas Copco Equipment for industry (including the foundry trade). Write for a copy to your local Atlas Copco company or agent or to the address below.

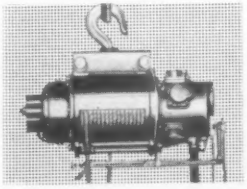


Atlas Copco

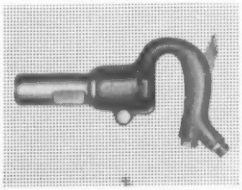
PUTS COMPRESSED AIR TO WORK FOR THE WORLD

Atlas Copco AB, Stockholm 1, Sweden. In the U.K: Atlas Copco (Great Britain) Ltd., Hemel Hempstead, Herts.

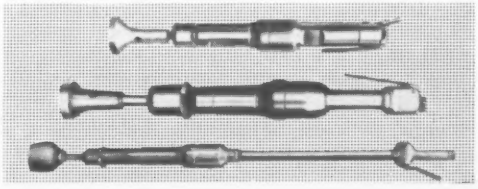
MLB 71 Air Hoist



R3B Chipping Hammer



3 Rammers from the Atlas Copco range



STR3

Raw Material Markets

Iron and Steel

Most of the ironfoundries maintained good outputs of castings and, comparatively, those most heavily employed continue to be the engineering and speciality foundries engaged in the production of high-duty castings. Of these, the foundries catering chiefly for the motor vehicle trade are the most heavily committed, but present delivery schedules are well up to recent levels. Production in many instances is, however, limited by insufficiency of suitable labour.

Raw materials for the foundries present no serious difficulties at present. The overall supply of the low phosphorus irons mainly used is adequate to cover all requirements. Although some brands are limited and insufficient to meet full requirements, others are available in equal analyses and quality to make good the deficiency and also that entailed by the decision of a Derbyshire producer to suspend production of the low phosporus iron for an indefinite period. Most of the foundries are covered for their needs for several weeks ahead for the low phosphorus irons, hematite, and refined grades.

The sustained demand for builders' castings keeps the light foundries producing them fairly well employed. There is also a steady call for castings from the domestic utensil trade, although there is some apprehension as to whether the recent credit restrictions will again adversely affect this trade. The jobbing and textile foundries have a fair amount of work on hand, but these together with the light foundries have capacity to spare. Their requirements of high phosphorus foundry pig-iron are easily met and present demands are below outputs. Producers have tonnages to spare and welcome the orders which come in from overseas buyers.

The heavy demand from the steelworks for basic pig-iron is maintained, and outputs from all producers are absorbed fully. Only limited supplies continue to be received from abroad, and the additional tonnages which will in the near future be forthcoming from additional furnace capacity will bring much needed relief in the supply position, particularly in some areas.

The foundries are fairly well covered for their scrap requirements, but arisings of the best quality steel and cast-iron scrap are readily accepted. Foundry coke deliveries are satisfactory and ganister, limestone, and firebricks are available on demand.

The re-rollers maintain good outputs of all their products and there is a sustained heavy demand for small bars, light sections, and reinforcing rods. Outputs continue to depend on the supply of steel semis and available labour, both of which are inadequate to meet all requirements. Home steelworks maintain a regular flow of billets, etc., but these are below demands particularly for 2-in. sq. billets. Some of the re-rollers are anxiously awaiting the consignments which are being imported.

All arisings at the steelworks of suitable re-rolling defectives and crops are being readily accepted by the re-rollers.

Non-ferrous Metals

Copper is a drifting market in London and the strike position in Chile and the disturbances last week in the Copperbelt of Northern Rhodesia influenced trading. In Chile the two mines, Potrerillos and El Salvador, belonging to the Anaconda Copper Company, are still on strike but the dispute has not extended to the remaining mines in the country—Chuquicamata and El Teniente. However, negotiations which had been broken off have now been resumed between the unions and the two mines affected. The disturbances in Rhodesia blew up suddenly last week and their basis has not yet been clearly defined. The situation eased last weekend, but the fact that a dangerous situation could blow up so suddenly has given the copper market food for thought. Anyway, consumers seem content to sit on the sidelines and wait for a definite trend to emerge.

Meanwhile stocks are increasing and Union Minière, the big Belgian Congo copper producer, has lowered its copper price by B.frs. 1.50 per kilo to B.frs. 35.50 per kilo. Accordingly, prices in London have drifted lower and the backwardation has closed up to around £5 a ton.

In the US the market is more active for the producers than for the custom smelters, but, on balance, the market is quiet and the price is unchanged at 33 cents a pound for both producers and custom smelters.

Tin is a good market in Singapore, inactive in London, and flat in New York. The chairman of the International Tin Council has announced that the UK stockpile had been entirely liquidated before the end of March this year. Other news of interest concerns the February consumption figures in the US which shows that tin absorbed in that month decreased by 2 per cent. but that total tin stocks were down to 37,960 tons from 39,635 tons at the beginning of the month. The US price has been edging up slowly but is still below $1 a pound.

Lead is the firmest market in London and cash metal is experiencing a squeeze which has carried the price to its highest level since November, 1957. Demand is satisfactory as is the outlook which has been helped by the news that Bunker Hill's Idaho lead and zinc mine has come out on strike. The possibility exists of this strike spreading to other US producers. US demand is also satisfactory and the price is unaltered at 12 cents a pound.

Zinc is still a mixed market and, on balance, softer. Demand is patchy and this comment applies also to prompt metal and prices have inclined easier. In the US demand is a little better for both prime western and special high grade metal. The price continues to be called 13 cents a pound.

NIFES Refresher Course

A wide range of subjects will be covered at the seventh annual residential refresher course of the National Industrial Fuel Efficiency Service at the Clarendon Laboratory, Oxford, from September 26 to 30. Each subject will be presented by an expert in the field and particular attention will be paid to practical application.

Among the subjects will be: "Coal and the Industrial Consumer," "Automation and its Impact on the Plant Engineer," "Five Years' Progress in Fuel Utilisation," "Role of the Central Engineering Workshop in the Maintenance Plan," "Recovery and Use of Waste Heat in Industry," and "Factors Affecting the Choice of Industrial Boiler Plant."

Recent Wills

HARROP, A. P., head of Yates, Haywood & Company, Limited, ironfounders and stove grate manufacturers, of Rotherham £26,897

RENDELL, OSCAR, a director of H. W. Kearns & Company, Limited, machine-tool manufacturers, etc., of Altrincham (Ches) £115,034

BROWN, G. M., for many years consulting electrical engineer to the United Steel Companies, Limited, and designer of the electric drive for one of the first Templeborough cogging mills in the country £6,369

Electrical Aids in Industry

Data Sheet **No. 12**

Dielectric Heating - 3

Some further details of the uses to which dielectric heating can be put are given in this data sheet, being continued from data sheet No. 11.

The Woodworking Industry

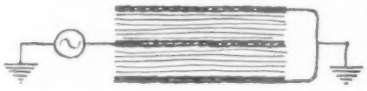
A most important development in recent years in the woodworking industry has been the introduction of synthetic resin adhesives of the thermosetting type for the bonding of wooden components. Setting of these resin adhesives proceeds at a rate largely determined by temperature. For instance, urea formaldehyde sets as follows :

TEMPERATURE	SETTING TIME
65°F	3 hours
80°F	1 hour
150°F	3 minutes
190°F	1 minute

The resultant bonded joint is equally satisfactory in each case. Most of the power supplied when dielectric heating is used is absorbed by the resin, the heat thus being concentrated where required.

Plywood

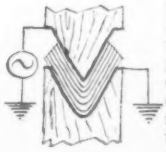
With dielectric heating consuming power only during the heating cycle, plywood can be produced with considerable savings in heating times and costs.



For example, in a press holding 100 3-ply ½" thick assemblies, the resin glue is set in 20-30 minutes, depending upon the dryness of the wood.

Curved Laminated Sections

Curved laminated sections are being increasingly used in contemporary furniture, and with dielectric heating rapid production can be achieved using wooden shaping blocks in single daylight presses. An alternative method of providing heat by conduction from heated metal strips is much slower as the total section thickness rises above 0.05 inch.



Furniture Assembly

Because of the savings in glueing processes already instanced, dielectric heating is being extensively used in the furniture trade. It leads also to reductions in labour and floor space, with the elimination of assembly jigs. The heating equipment can be placed directly in the production line, cutting handling to a minimum.

Blockboard

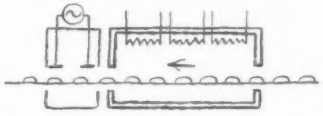
Blockboard, having large areas of glue line, provides an excellent use for dielectric heating, which gives considerable savings in time and labour.

Other Resin-bonded Products

Dielectric heating is also used in the manufacture of other resin-bonded or impregnated products such as grinding wheels, fabrics, felts, etc.

Foodstuffs

Increased use is being made of dielectric heating in many food processes; these include defreezing and melting, sterilisation and disinfestation, drying of breakfast cereals, dog biscuits, etc., and similar applications. Some cooking processes, such as bread baking, are technically possible, but dielectric heating gives an 'unbrowned' product. In the biscuit trade, however, dielectric heating is combined with conventional baking to produce normal biscuits in ⅓ to ½ the usual baking time.



The examples given here cover only a part of the field open to dielectric heating.

For further information, get in touch with your Electricity Board or write direct to the
Electrical Development Association,
2 Savoy Hill, London, W.C.2.
Telephone: TEMple Bar 9434.

Excellent reference books on electricity and productivity (8/6 each, or 9/- post free) are available—"Induction and Dielectric Heating" is an example.

E.D.A. also have available on free loan in the United Kingdom a series of films on the industrial uses of electricity. Ask for a catalogue.

7569.4

Current Prices of Iron, Steel, and Non-ferrous Metals

(Delivered unless otherwise stated)

May 18, 1960

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2, 10-ton lots or over: Middlesbrough, £21 6s. 0d.; Birmingham, £20 18s. 3d.

Low-phosphorus Iron.—Over 0.10 to 0.40 per cent. P, 10-ton lots or over, £23 5s. 0d., delivered Birmingham, £23 10s. 0d., delivered Grangemouth.

Cylinder and Refined Irons.—North Zone, £25 6s. 6d.; South Zone, £25 9s. 0d.

Refined Malleable.—P, 0.10 per cent. max.; North Zone, £26 6s. 6d.; South Zone, £26 9s. 0d.

Hematite.—Si up to 2 per cent., S. & P. over 0.03 to 0.05 per cent., 10-ton lots or over: N.-E. of England (local iron), £23 19s. 0d.; Scotland (Scotch iron), Zone S.1, £24 5s. 6d.; Sheffield, £25 7s. 6d.; Birmingham, £25 14s. 0d.; Wales (Welsh iron), £23 19s. 0d.

Basic Pig-iron.—£20 3s. 0d., delivered Staffs, Derbyshire, Notts, Lincs, Rutland, Northants, and Leicestershire in 10-ton lots or over.

FERRO-ALLOYS

(Per ton unless otherwise stated, delivered)

Ferro-silicon (6-ton lots and over).—45 per cent. Si, £41 10s. 0d. to £44 0s. 0d., scale 15s. 0d. per unit, lumpy; 75 per cent. Si, £57 0s. 0d. to £62 10s. 0d., scale 15s. 0d. per unit, lumpy.

Ferro-vanadium.—50/60 per cent., 22s. 6d. per lb. of V.

Ferro-molybdenum.—65/70 per cent., carbon-free, 12s. 10d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., 2-3 per cent. Cu, £250 0s. 0d.; 38/40 per cent., commercially carbon-free, £287 0s. 0d.

Ferro-tungsten.—80/85 per cent., 11s. 6d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 14s. 6d. per lb. of W.

Ferro-chrome (6-ton lots and over, lumpy).—4/6 per cent. C, £78 10s. 0d. to £82 10s. 0d., basis 60 per cent. Cr. scale 26s. 0d. to 28s. 6d. per unit; over 6 per cent. C, £77 0s. 0d. to £80 10s. 0d., basis 60 per cent. Cr, scale, 26s. 0d. to 28s. 6d. per unit; 2 per cent. C,* 1s. 8d. to 1s. 11d. per lb. Cr; 1 per cent, C,* 1s. 8½d. to 1s. 11½d. per lb. Cr; 0.15 per cent. C,* 1s. 9½d. to 2s. 0½d. per lb. Cr; 0.10 per cent C,* 1s. 9¾d. to 2s. 0¾d. per lb. Cr; 0.06 per cent. C,* 1s. 10¼d. to 2s. 1d. per lb. Cr.

Metallic Chromium.—98/99 per cent., 6s. 10d. per lb.

Metallic Manganese.—94/96 per cent., carbon-free, £275 0s. 0d.; 9 6/98 per cent., £285 0s. 0d.

Ferro-columbium.—65/67 per cent., Cb + Ta, 19s. 9d. per lb., Cb + Ta.

Ferro-manganese (Standard).—78 per cent., £61 10s. 0d.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft u.t., 100 tons & over, £31 15s. 6d.; tested, 0.08 to 0.33 per cent. C, 6 to 35 tons, £33 15s. 6d.; hard (0.41 to 0.60 per cent. C), under 10 tons, £34 17s. 0d.; silico-manganese, under 10 tons, £43 16s. 6d.; free-cutting, under 10 tons, £36 14s. 6d. SIEMENS MARTIN ACID (under 10 tons): Up to 0.25 per cent. C, £41 1s. 0d.; silico-manganese, £44 4s. 0d.

Billets, Blooms, and Slabs for Forging and for Stamping (under 10 tons).—Basic, soft, up to 0.33 per cent. C, £38 10s. 0d.; basic, hard, over 0.41 up to 0.60 per cent. C, £39 12s. 6d.; acid, up to 0.25 per cent. C, £43 4s. 0d.

* Average 68–70 per cent.

FINISHED STEEL

Heavy Plates and Sections (1 ton to 10 tons).—Ship plates (N.-E. Coast), £41 12s. 0d.; boiler plates (N.-E. Coast), £44 2s. 0d.; floor plates (N.-E. Coast), £43 10s. 0d.; angles (N.-E. Coast), £38 16s. 6d.; joists (N.-E. Coast), £38 12s. 6d.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., and flats 5 in. wide and under, untested soft basic, 50 tons and over, £39 1s. 0d.; under 10 tons to 4 tons, £40 18s. 0d.; under 4 tons to 2 tons, £41 3s. 0d.; hoop and strip, coils, 100 tons and over, £38 0s. 0d.; uncoated strip mill coils, hot rolled, under 3 mm. to 12g., 25 tons to under 50 tons, £43 16s. 0d.; black sheets (hand mill), 24g., 10 tons and over. £57 14s. 6d.; galvanized corrugated sheets, 24g., 10 tons and over, £68 5s. 0d.

Alloy Steel Bars.—1 in. dia. and up: Nickel, £67 17s. 0d.; nickel-chrome, £98 11s. 0d.; nickel-chrome-molybdenum £111 4s. 0d., in lots of 5 tons to under 10 tons.

NON-FERROUS METALS

Copper.—Cash, £248 10s. 0d. to £248 15s. 0d.; three months, £244 10s. 0d. to £244 15s. 0d.; settlement, £248 15s. 0d.

Copper, Tubes, etc.—Solid-drawn tubes, 2s. 5d. per lb.; rods, 259s. 0d. per cwt. basis; 20 s.w.g., 294s. 0d. per cwt.

Tin.—Cash, £785 10s. 0d. to £786 0s. 0d.; three months, £785 10s. 0d. to £786 0s. 0d.; settlement, £786 0s. 0d.

Lead (Refined Pig).—Second half May, £77 15s. 0d. to £77 17s. 6d.; second half August, £77 0s. 0d. to £77 2s. 6d.

Zinc.—Second half May, £92 0s. 0d. to £92 5s. 0d.; second half August, £91 17s. 6d. to £92 0s. 0d.

Zinc Sheets, etc.—Sheets, 15g. and thicker, all English destinations, £127 0s. 0d.; rolled zinc (boiler plates), all English destinations, £124 15s. 0d.; zinc oxide (Red Seal), d/d buyers' premises, £105 0s. 0d.

Brass Tubes, etc.—Solid-drawn tubes, 2s. 0½d. per lb.; sheets to 10 w.g., 213s. 3d. per cwt.; wire, 2s. 9¾d.; rolled metal, 213s. 3d. per cwt.

Brass (Brazing).—BS1400, B3, £168; B6, £219.

Brass (High Tensile).—BS1400, HTB1, £197; HTB2, £216; HTB3, £231.

Gunmetal.—BS1400, LG2, £208; LG3, £218; G1, 1%, £273; G1, 1%, £260.

Phosphor Bronze.—BS1400, PB1 (AID released), £307; BS1400, 90/10/1, £294.

Leaded Phosphor Bronze.—BS1400, LPB1, £228.

Phosphor Bronze Strip, etc.—Strip, 301s. 0d. per cwt.; wire, 4s. 2¼d. per lb.; rods, 3s. 5d.; tubes, 3s. 5d.; chill cast bars, solids 3s. 4¾d.; cored 3s. 5d. (CHARLES CLIFFORD, LIMITED).

Nickel Silver, etc.—Rolled metal, 3 in. to 9 in. wide × 0.056, 4s. 0d. per lb.; round wire, 10g. in coils (10 per cent.), 4s. 5d.; special quality turning rod, 10 per cent., ½ in. dia., in straight lengths, 4s. 4d. All prices are net.

Other Metals.—Magnesium, ingots 2s. 2½d. to 2s. 3d. per lb. Antimony, English, 99 per cent., £190 0s. 0d. Quicksilver, ex-warehouse, £70 10s. 0d. Nickel, £600 0s. 0d. Aluminium, ingots, £186 0s. 0d.; aluminium bronze (BS1400), AB1, £252; AB2, £260.

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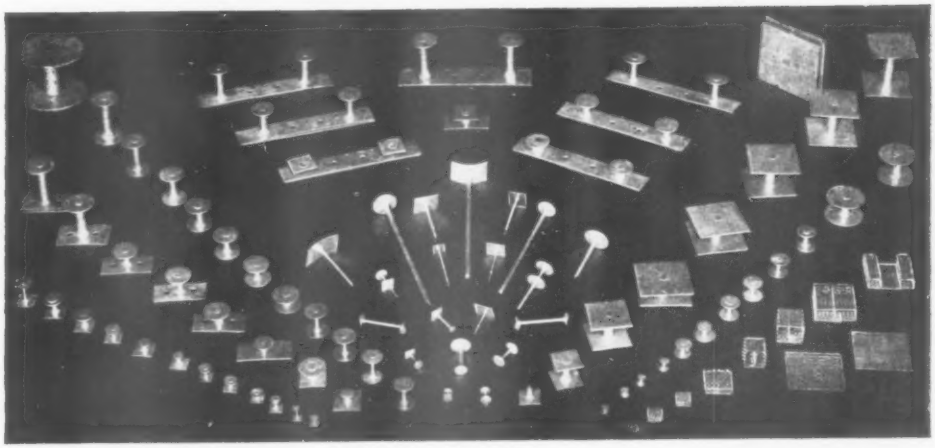

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Company News

JOHN G. KINCAID & COMPANY, LIMITED, marine engineers and boilermakers, of Greenock—Net profit for 1959 was £180,246 (£151,708) and the final dividend of 15 (12) per cent. makes 18 (15) per cent. for the year.

CHAMBERLIN & HILL, LIMITED, grey ironfounders, etc., of Walsall (Staffs)—Profit was £29,774 (£11,414), after tax of £24,758 (£13,699), and the final dividend of 11½ per cent. makes 17½ (15) per cent. for the year to March 31, 1960.

ARMSTRONG WHITWORTH (METAL INDUSTRIES), LIMITED—Final dividend of 10 (7½) per cent. makes 12½ (10) per cent. for 1959. The net profit of £224,712 (£205,618), after tax of £230,980 (£196,633), is a record for the company.

JOHN LYSAGHT, LIMITED, (a subsidiary of Guest, Keen & Nettlefolds, Limited)—Net profit for 1959 was £1,778,439 (£1,946,630), after tax of £1,831,154 (£1,833,980). The preference dividend takes £22,050 (£20,700) and the ordinary £1,550,000 (£1,300,000).

INTERNATIONAL NICKEL COMPANY OF CANADA, LIMITED—Net sales for the first quarter of 1960 advanced to $140,592,000 ($96,595,000) and net earnings rose to $24,932,000 ($16,984,000) or 85 (58) cents a share. Deliveries of nickel in all forms during the period were at a record level and at a rate greater than production.

A. A. JONES & SHIPMAN, LIMITED, manufacturers of machine and small tools, of Leicester—The chairman, Mr. F. G. Morris, states that with the exception of a mortgage loan, the business has been financed by its internal savings. In order to conserve current assets, it may be decided later in the year to issue new shares.

G. & J. WEIR (HOLDINGS), LIMITED—Group net profits were £1,256,143 (£1,123,173) and the dividend for the year is 18 (17) per cent. Viscount Weir, the chairman, states that a reduction in gross earnings for 1960 must be expected. The prospects for the shipbuilding industry remain depressing, but there are encouraging expectations of potential business on the land side.

ROLLS-ROYCE, LIMITED—Final dividend of 7½ per cent. makes 10 per cent. for 1959 on capital increased by a 100 per cent. scrip issue and the issue of additional Workers' (1955) shares. This is equivalent to the 20 per cent. paid on the old capital in 1958. Group sales rose by nearly £1,170,000 to £96,560,000 and the net profit was £2,634,854 (£2,233,482), after tax of £2,240,000 (£2,520,000).

R. A. LISTER & COMPANY, LIMITED, agricultural engineers, etc., of Dursley (Glos)—The directors expect to recommend a final dividend of at least 9 per cent. on the ordinary capital as increased by the recently proposed one-for-six rights issue at 47s. 6d. a £1 share. A 14 per cent. total was paid for the year ended September 30, 1959 and an unchanged 5 per cent. interim is payable next month.

WILLIAM DENNY & BROS., LIMITED, shipbuilders and engineers, of Dumbarton—Work in hand is sufficient to keep shipyard and engine works occupied during the year, states the chairman, Mr. E. L. Denny, but further orders are needed soon if all departments are to be kept busy in 1961. Labour difficulties pose a more serious problem than low freight rates and excessive world shipbuilding capacity. The dividend is raised to 15 (12½) per cent. and there is a 5 per cent. special dividend on account of the financial outcome of contracts completed in earlier years.

Steel Output Maintained

The Easter holidays affected steel output in April, but the average weekly output at 478,100 tons was only 7,000 tons under the record March figure of 485,100 tons and well above the 387,300 tons of April, 1959. Preliminary figures confirm the expected rise in stocks held by consumers and merchants and suggest, states the Iron and Steel Board, that an increase of about 225,000 tons (ingot equivalent) may be reached during the first quarter of the year.

Consumption during the first quarter of the year is estimated to have been about one quarter higher than in the corresponding period last year and an additional 1,000,000 tons of steel were required. In addition, the change from running down to building stocks accounted for an extra 500,000 tons. Steel production will be increased during the course of the year as a result of the starting of new capacity, but this will be partly offset by the seasonal decline in output during the holiday period.

There may also be some reduction from the current high level of exports partly because of increased competition and partly because of the increased home demand. At the same time imports are tending to increase.

10 Per Cent. Increase in Deliveries

Deliveries of steel from UK mills increased by about 10 per cent. from the last quarter of 1959 to the first quarter of 1960. The increase was spread fairly generally over all products. Only deliveries of plate, rails, colliery arches, and forgings and castings are still below the previous peak levels reached in the last quarter of 1957, although for heavy sections the improvement is due to increased deliveries to export.

Latest pig-iron and steel output figures (in tons), with the corresponding 1959 returns, are shown in the following table:—

Period.	Pig-iron.		Steel ingots and castings.	
	Weekly average.	Annual rate.*	Weekly average.	Annual rate.*
1960—February ..	301,500	15,680,000	482,200	25,073,000
March ..	312,300	16,238,000	485,100	25,226,000
April ..	310,600	16,150,000	478,100	24,861,000
1959—February ..	221,800	11,536,000	347,400	18,065,000
March ..	221,200	11,501,000	362,700	18,860,000
April ..	231,300	12,027,000	387,300	20,139,000

* No allowance is made for holidays and figures for months not affected by holidays should be reduced by about 1,000,000 tons.

Head Wrightson Orders

Receipt of two orders worth £2,500,000 for steel-strip handling equipment is announced by Head Wrightson Machine Company, Limited, of Middlesbrough, a subsidiary of Head Wrightson & Company, Limited. All the work will be undertaken by the group's various establishments on Tees-side.

One order is for the supply of five cut-up lines for the new Spencer Works at Llanwern (Mon) of Richard Thomas & Baldwins, Limited. Two of these lines will be designed to handle hot-rolled material and three for handling cold-rolled strip. They are expected to be in full production by October next year.

The other order is for two steel-strip lines, of almost identical design, for the new Ravenscraig plant of Colvilles, Limited. Head Wrightson is already engaged on the provision of similar lines for South Africa and Australia, and also for the Steel Company of Wales, Limited, and John Summers & Sons, Limited, Shotton.

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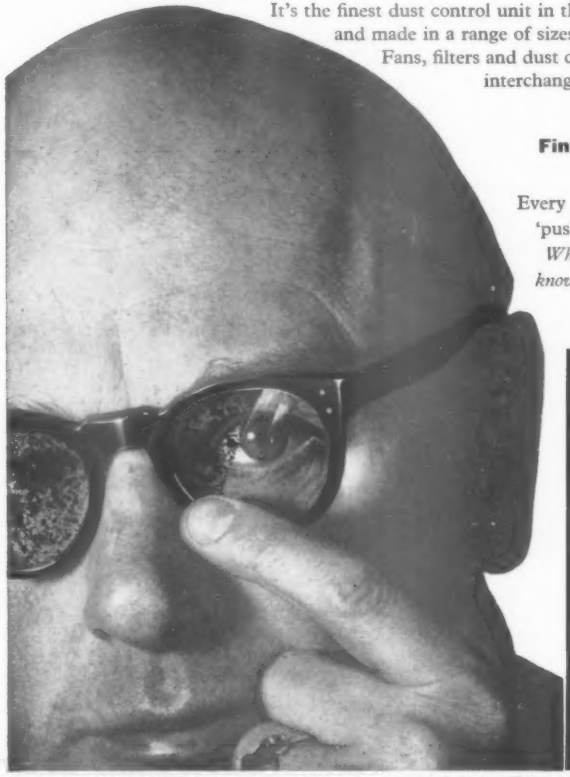
For over 40 years we've been putting industrial dust safely out of the way before it can harm men or machines. In that time we've made a number of major contributions in our field—the development of the unit dust collector, for instance. We've made tens of thousands of them. Here is one of the very latest range . . .

DALLOW LAMBERT

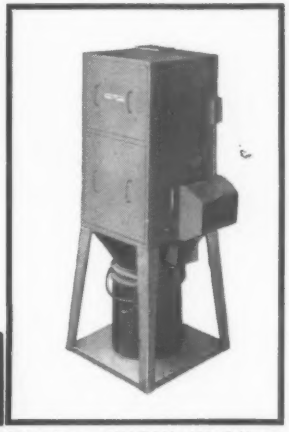
Meet the new DALLOW LAMBERT **Unimaster**



It's the finest dust control unit in the world. It's compact, powerful and made in a range of sizes—70 to 250 sq. ft. of filter area. Fans, filters and dust containers are made in a range of interchangeable sizes, giving a tremendous flexibility of application.

Finally—NO MORE HAND SHAKING!

Every Unimaster incorporates our new 'push button' filter cleaning method. *Whatever your industry you ought to know more about the UNIMASTER. Write or phone for further information.*



DALLOW LAMBERT & CO. LTD., THURMASTON LEICESTER. Telephone: SYSTON 3333 (7 lines)
CRC 90

Imports and Exports of Iron and Steel in March

The following tables, based on Board of Trade returns, give figures of imports and exports of iron and steel in March this year. Totals for the first quarters of 1959 and 1960 are also included.

Total Exports of Iron and Steel

Destination.	Month ended March 31.	Three months ended March 31.	
	1960.	1959.	1960.
	Tons.	Tons.	Tons.
Cyprus	166	343	420
Sierra Leone	462	1,389	1,245
Ghana	2,790	7,891	5,915
Nigeria	6,535	18,870	17,418
Union of South Africa	5,914	14,673	18,017
Rhodesia and Nyasaland	2,374	5,309	5,620
Tanganyika	882	6,611	2,384
Kenya	1,360	7,120	4,947
Uganda	106	2,088	421
Mauritius	719	400	1,183
Aden	215	696	462
Bahrein, Qatar, and Trucial States	3,400	3,126	4,951
Kuwait	722	4,428	1,394
India	30,630	39,769	70,861
Pakistan	5,409	8,938	19,621
Singapore	1,840	6,723	4,331
Malaya	1,418	2,954	4,624
Ceylon	5,368	12,286	14,992
British North Borneo	347	543	1,282
Hongkong	6,115	15,893	18,001
Australia	11,168	24,190	41,704
New Zealand	9,121	24,014	24,557
Canada	16,250	24,488	55,367
Jamaica	3,302	5,355	7,378
Trinidad	5,034	8,182	11,899
British Guiana	694	1,342	1,916
Other Commonwealth countries	3,433	10,213	9,650
Eire	5,437	10,410	15,696
Soviet Union	3,746	528	7,206
Finland	2,579	5,401	9,028
Sweden	16,595	29,247	56,927
Norway	12,229	22,618	35,654
Denmark	8,978	21,994	26,961
Western Germany	14,034	27,924	49,051
Netherlands	13,535	17,199	37,938
Belgium	2,330	7,426	10,241
France	1,038	583	2,245
Switzerland	751	2,082	3,096
Portugal	1,202	3,991	3,914
Spain	6,272	5,369	9,101
Italy	4,419	11,580	12,202
Austria	738	653	1,350
Yugoslavia	3,659	825	5,565
Greece	960	3,195	4,087
Turkey	619	1,489	976
Netherlands Antilles	264	745	1,558
Portuguese East Africa	193	434	1,076
Egypt	2,501	1,090	6,180
Sudan	852	2,801	3,028
Lebanon	80	92	354
Israel	1,439	1,926	6,653
Saudi Arabia	50	2,207	148
Iraq	2,177	30,810	7,695
Iran	10,700	9,039	26,008
Burma	601	1,542	2,532
Thailand	425	2,709	2,359
Indonesia	3,307	880	7,970
China	3,582	18,909	17,386
Japan	16,391	18,717	27,431
Philippine Republic	472	838	2,604
USA	24,883	21,870	87,359
Cuba	984	1,239	2,542
Colombia	310	295	2,710
Venezuela	3,637	25,277	11,881
Ecuador	106	290	600
Peru	815	744	1,902
Chile	205	532	651
Brazil	2,075	4,519	5,499
Uruguay	1,026	480	2,937
Argentina	7,920	45,340	26,702
Other foreign countries	13,520	11,671	36,431
TOTAL	323,500	635,344	933,994

Total Imports of Iron and Steel

From	Month ended Mar. 31.	Three months ended March 31.	
	1960.	1959.	1960.
	Tons.	Tons.	Tons.
Union of South Africa	3,384	6,346	12,963
Rhodesia and Nyasaland	420	1,033	1,920
Canada	1,339	2,438	7,232
Other Commonwealth countries and Eire	3,211	2,776	9,726
Soviet Union	5,264	1,892	12,871
Sweden	4,574	6,439	11,802
Norway	11,307	18,441	33,427
Poland	3,534	605	6,620
Western Germany	17,359	7,340	43,802
Netherlands	14,380	37,355	44,494
Belgium	10,301	5,713	21,237
Luxembourg	1,277	1,588	2,938
France	5,525	5,464	15,099
Italy	1,682	214	4,027
Austria	1,280	921	3,318
Japan	792	529	1,967
USA	16,214	3,370	28,020
Other foreign countries	3,843	2,031	7,937
TOTAL	105,686	104,495	269,405
Iron and steel scrap and waste, fit only for the recovery of metal	18,602	520	42,154

Exports of Iron and Steel, by Product

Product.	Month ended March 31.	Three months ended March 31.	
	1960.	1959.	1960.
	Tons.	Tons.	Tons.
Pig-iron	14,279	31,380	58,695
Ferro-columbium (niobium)	19	16	40
Ferro-tungsten	115	390	323
Other ferro-alloys	906	827	2,443
Ingots, blooms, billets, slabs, sheet bars (incl. tinplate bars), and similar primary forms	4,493	18,874	17,795
Pieces roughly shaped by forging	363	310	476
Iron bars, rods, angles, shapes, and sections	88	253	434
Steel bars, rods, angles, sections, and shapes	55,236	69,348	166,733
Iron plates and sheets	157	105	304
Universal plates	1,806	2,448	5,540
Steel plate, 3mm. and under 4.5mm. thickness	3,168	12,142	8,981
Ditto, 4.5mm. or more in thickness	42,386	34,247	92,749
Blacksheets and blackplate	29,353	61,438	82,900
Hoop and strip	9,181	16,771	25,520
Tinplate	40,388	115,617	147,585
Decorated tinplate	543	2,752	1,056
Galvanized sheets	7,118	22,442	18,249
Other (incl. tinned sheets, terneplate, and ternesheets)	3,001	3,483	8,857
Railway and tramway construction material	17,878	43,578	37,360
Wire rods of steel (incl. alloy steel)	4,959	8,272	16,606
Wire	12,958	22,804	32,634
Tubes, pipes, and fittings	75,105	167,847	208,714
TOTAL	323,500	635,344	933,994

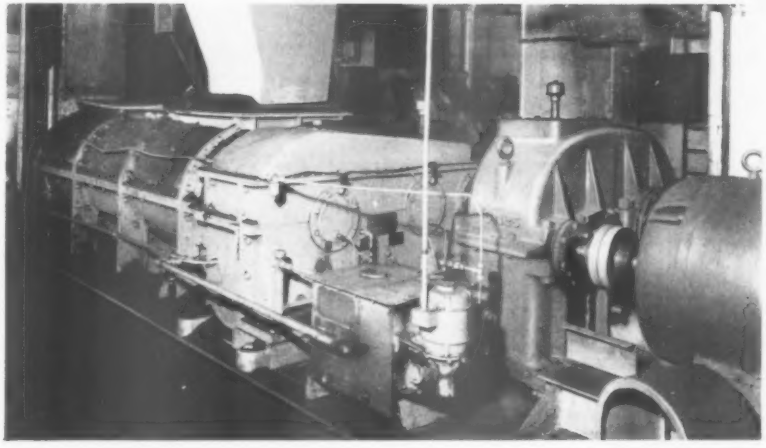
Mr. A. A. SMITH has been appointed a director of Hopkinsons, Limited, valve manufacturers, Huddersfield, Yorkshire.

Mr. E. A. WARD has been appointed secretary of Lancashire Dynamo Electronic Products, Limited, of Rugeley, Staffordshire, a member of the Metal Industries group.

BAKER PERKINS FOUNDRY TEAM

-proved unbeatable in U.S.A.

The photograph below shows one of eight matched Baker Perkins units chosen to provide all the mixing requirements for an automotive grey iron foundry in the U.S.A. A strong line of five B-P (150 tons per hour) 5A Continuous Moulding Sand Mullers delivers consistently uniform sand into the moulding shop.
Behind them a B-P Core Paste Mixer and a B-P Core Wash Mixer ensure excellent core surfaces. Centre of the team is the B-P Refractory Clay Mixer for lining ladles and cupolas.
After four years of gruelling operation this B-P equipment has proved itself in all respects. It is built to do a rugged job consistently and with minimum maintenance.



For further details of this and other foundry machinery write to :

Baker Perkins Limited, *Engineers*

BEDEWELL DIVISION, HEBBURN-ON-TYNE, Co. DURHAM. Tel: Jarrow 897124

BPF9

CLASSIFIED ADVERTISEMENTS

PREPAID RATES: Fifteen words for 7/6 (minimum charge) and 4d. per word thereafter. Box Numbers 2/6 extra (including postage of replies). Situations wanted 2d. per word throughout.

Advertisements (accompanied by a remittance) and replies to Box Numbers should be addressed to the Advertisement Manager, Foundry Trade Journal, John Adam House 17/19, John Adam Street, Adelphi, London, W.C.2. If received by first post Monday advertisements can normally be accommodated in the following Thursday's issue.

SITUATIONS WANTED

MANAGER, 47, aluminium and magnesium gravity die castings, seeks position. Fair knowledge of pressure castings. Considerable experience gained over 30 years at large foundries. Senior positions held in drawing office, foundry and commercial including senior executive. Residing South East London, anything considered. Box MF441, FOUNDRY TRADE JOURNAL.

TECHNICAL REPRESENTATIVE with extensive connection in London and Home Counties with large industrial groups wishes to represent a foundry for cast iron non-ferrous die castings etc. Good personal connection commission and part expenses. Box TR640, FOUNDRY TRADE JOURNAL.

PLANT ENGINEER (40), A.M.I.Plant.E., A.M.I.B.F., seeks new position. Comprehensive experience installation, development, maintenance mechanised foundries, machine shops, process plant, etc. Salary envisaged £1,500—£1,800 plus housing. Box PE592, FOUNDRY TRADE JOURNAL.

FOUNDRYMAN (40), M.I.B.F., nine years' managerial experience all aspects ferrous and non-ferrous production, mechanised, jobbing. At present employed Ceylon. Free August, 1960. Seeks position with reputable company. Anything considered. Could represent foundry plant, or allied concern such as refractories, etc. S.E. Asia or elsewhere. All replies to be addressed to Box FO618, FOUNDRY TRADE JOURNAL.

FOUNDRY ENGINEER seeks change, age 44. Comprehensive experience, methods, planning of production, plant installation, maintenance, mechanised plants—mec. and elec. West Midland area. Box FE646, FOUNDRY TRADE JOURNAL.

ENGINEER, 40. Good background and experience in modern Mechanised Foundries, seeks position as Works or Chief Engineer, M.I.C.E., A.M.I.B.F., etc. Accustomed to full control. Malleable, steel. Box EF635, FOUNDRY TRADE JOURNAL.

FOREMAN, thoroughly experienced in Aluminium Gravity Die Casting, capable of working on own initiative, desires change. Box FT636, FOUNDRY TRADE JOURNAL.

ENERGETIC 30-year-old executive Director, with sales and production experience in light engineering industry seeks directorship with progressive small or medium size company engaged in the production and sales of their own branded products. Capital available. Write Box MY/66, c/o 95, Bishopsgate, E.C.2.

SITUATIONS VACANT

REQUIRED, ENGINEER with wide experience of modern mechanised foundries and preferably mains frequency induction melting/plant. Must be capable of co-ordinating proposals of various contractors engaged in layout and equipping of new foundry to produce large numbers of small semi-precision castings. This is a permanent position with a firm of good repute. Please reply stating age, experience in chronological order and salary required to Box RE604, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT—*contd.*

METALLURGICAL CHEMIST required to take charge of laboratory employing people on Chemical and Metallurgical Analysis in connection with a large Iron Foundry situated in a pleasant area of the South Coast. Housing available. Please reply in writing, stating age, experience and salary required. Box ME629, FOUNDRY TRADE JOURNAL.

SENIOR FOUNDRY FOREMAN with experience of Blackheart malleable iron required for modern mechanised foundry. This is a position in which individual ability will be fully supported and recognised by a progressive management. Housing can be arranged in the new town of Cwmbran situated in the pleasant countryside of Monmouthshire. Please apply, giving full details of age, training, experience and present position, to MR. A. D. MELLISH, Guest, Keen & Nettlefolds (Cwmbran), Ltd., Cwmbran, Mon. All replies will be treated with the strictest confidence.

FOUNDRY SUPERINTENDENT required for modern jobbing foundry situated in Gloucestershire producing medium size grey and high duty iron engineering castings up to 2 tons in green sand and CO_2. Excellent prospects for the right man but only first class foundryman capable of directing all operations on the shop floor should apply, stating age, experience, and salary required to Box FS609, FOUNDRY TRADE JOURNAL.

SENIOR DRAUGHTSMAN required with experience of Gravity and Pressure Dies or Moulds. Only competent men, able to command high salary, need apply. Works situated within 20 miles of North London. Apply Box SD580, FOUNDRY TRADE JOURNAL.

Engineering Group with small Modern Foundry require

FIRST-CLASS SKILLED FOUNDRY WORKING MAINTENANCE ENGINEER.

Must have working Electrical Knowledge and experience on all Foundry Plant—Grey Iron and Non-Ferrous, Jobbing and Mechanised.

This is a new post in an expanding organisation in pleasant South of England country town. Good pay and prospects. Housing available near good schools and shops and within easy reach of London.

Youngish married man preferred. Must be methodical, keen and efficient.

Apply in own writing, giving full particulars and copies of any available testimonials to.

Box EG633, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT—*contd.*

REQUIRED for Calcutta. FOUNDRY MANAGER conversant with production of non-ferrous metal castings. Knowledge of gravity die casting would be an advantage. Age preferably between 25/30. Salary: £2,000 per annum plus bonus scheme and accommodation allowance. Apply A. COHEN & Co. LTD., 8, Waterloo Place, S.W.1.

FOUNDRY FOREMAN required (Midlands area). Experienced Blackheart Malleable. First class opportunities of advancement for man with drive and initiative. Pension Scheme. Full sports and social facilities. Staff appointment. Write, giving full details of age and experience, together with salary required to Box FF608, FOUNDRY TRADE JOURNAL.

SMALL IRON FOUNDRY in country district of North Staffordshire require a first-class Jobbing Iron Moulder preferably with Pump experience up to 2 tons. Works house—Modern—3 Bedrooms—available for right man. Age immaterial. Fullest details of experience in confidence. Write Box SM603, FOUNDRY TRADE JOURNAL.

FIRST CLASS REPRESENTATIVE with good connections in Midlands and Southern England, for sale of aluminium castings. Excellent opportunities for right man with ability and enthusiasm. Good salary, expenses paid, and car provided. Applicants should state details of present salary, experience, and connections to Box 592, DORLAND ADVERTISING, LTD., 28, Haymarket, S.W.1.

MOULDERS. Skilled General Moulders required, used to high class engineering work, 1 cwt. to 2 tons, iron or aluminium. Piece work earnings £20/£23 for good men. Smethwick/Oldbury district. Apply Box MO443, FOUNDRY TRADE JOURNAL.

ASSISTANT FOREMAN for up to date Core Shop employing skilled male and semi-skilled female labour. Must have experience in the quantity production of small cores. Good salary and prospects. Home Counties Area. Apply Box AF445, FOUNDRY TRADE JOURNAL.

FOREMAN required for modern Iron and Steel Foundry, in Midlands area. Good knowledge of mechanised production most essential. Apply Box FR637, FOUNDRY TRADE JOURNAL.

HADFIELDS LTD., Steel Manufacturers and Heavy Engineers, require an additional SALES REPRESENTATIVE for the Midlands Area, to be based on their Birmingham Office. Candidates should have a suitable engineering or metallurgical qualification and experience. Replies, giving full details, should be addressed to THE PERSONNEL MANAGER, East Hecla Works, Vulcan Road, Sheffield, 9.

FOUNDRY FOREMAN required for Stourbridge area. Must be fully experienced Moulder of Grey Iron Castings for jobbing and production. Able to train labour. Only fully experienced men with initiative need apply. The position could lead to Managerial status after proved ability, and offers scope for advancement. Apply Box FF630, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT—*contd.*

MIDLANDS TECHNICAL REPRESENTATIVE, preferably based Birmingham area, for the sale of iron and steel foundry Refractories, chiefly foundry ceramics and holloware. Practical modern foundry experience essential. Under 25 years. Full relevant details to Box MT616, FOUNDRY TRADE JOURNAL.

FOUNDRY FOREMAN required for non-ferrous Production Foundry, four Power Machines. Young practical man, able to take full charge immediately or after two years service. Full history, salary required. Box FF599, FOUNDRY TRADE JOURNAL.

METALLURGICAL CHEMIST experienced in ferrous and non-ferrous metals and raw materials for work in our expanding chemical laboratories. Good prospects for the accepted applicant. Shift working, staff appointment, superannuation scheme, staff dining room. Apply in confidence stating age and experience to PERSONNEL OFFICER, WEST YORKSHIRE FOUNDRIES LIMITED, Sayner Lane, Leeds 10.

ELECTRIC FURNACE SALES ENGINEER.

A HIGHLY qualified Sales Engineer who is well introduced in the foundry industry is required by Company holding the representation of leading manufacturers of electric furnaces, who are specialists in low frequency coreless and channel type induction furnaces, heat treatment and annealing furnaces of all types. Excellent salary and commission offered with ultimate Directorship. Reply giving full particulars to THE BIRMINGHAM MACHINERY CO., LTD., Daimler House, Paradise Street, Birmingham, 1.

MANUFACTURERS AGENT. Well-connected in the Midlands Foundries requires further agency, on commission basis. Box MA634, FOUNDRY TRADE JOURNAL.

MACHINERY WANTED

REQUIRED. One Osborn Jolt Ram Roll-over Moulding Machine, size No. 602. State price and where can be inspected. WILLEY & Co. LTD., Water Lane, Exeter.

WANTED. Ladle for steel. Capacity 12/20 tons. With or without mechanical tipping gear. Bottom pouring gear an advantage. Box WL638, FOUNDRY TRADE JOURNAL.

WANTED

MOULDING M/cs: HPL1, and 2. Titan 75-lb. Core Blower. Redford Bench Type Ditto. Fordath Core Sand Mixer, 5-10 cwt. Sand Mills: 3 ft. 6 in. to 6 ft. diam. Box MO628, FOUNDRY TRADE JOURNAL.

5 TON Second Hand Top Charged Eletric-Arc Steel Melting Furnace required. Not exceeding 20 years old. Box FT442, FOUNDRY TRADE JOURNAL.

wanted . . .

for proposed expansion of existing mechanised foundry, all types of suitable second hand equipment:—Sand and mould handling plant, melting and core shop equipment, etc. Full details to include approximate specification, condition, years in use, price wanted and where viewed, to

Box WA645, FOUNDRY TRADE JOURNAL

MACHINERY WANTED—*contd.*

WANTED.—20 Ton E.O.T. Crane, approx. 44 ft. span, compressor 300 C.F.M. Box WA612, FOUNDRY TRADE JOURNAL.

URGENTLY WANTED

BMM Moulding Machines, type HPL, AT and RD. Large quantities of Steel Moulding Boxes. Box UW585, FOUNDRY TRADE JOURNAL.

MACHINERY FOR SALE

FOR SALE: One Dennison Crane Weighing Machine. Steelyard type. 5 tons × 2 lb. divisions. Apply: R. W. COLLIN, LTD., Pallion Foundry, Sunderland.

MORGAN 15-CWT. TYPE C.A. TILTING FURNACE with Burner, Fan, Oil Pump and Heater, also 14 ft. high × 6 ft. diam. welded Fuel Tank, excellent condition.

S. C. BILSBY & CO.,
Hainge Road, Tividale, Tipton, Staffs.
'Phone: Tipton 2448.

ACME CORE STOVE FOR SALE.

ACME Gas-Heated Two Loop Continuous Vertical Core Drying Stove, about 16 ft. × 9 ft. × 6 ft. × 27 ft. 7 in. high, with Electrically Operated Automatic Loading and Unloading Device, working in conjunction with Parker-Mitchell Electrically-driven Continuous Pendulum Chain Conveyor, about 240 ft. long, having 43 trays, 7 ft. 6 in. × 2 in.; also Parker Mitchell Overhead Travelling Electric Hoist Block and Runway, with 3½ cwt. Bottom Discharge Bucket. The electrical equipment is for A.C. three-phase 50-period 440 volt supply, with Dewhurst and Igranic Contactor Control Panels. For further particulars and appointment to view please reply to:

MESSRS. WEIR FOUNDRIES, LTD.,
Pontefract Lane, Leeds, 9.

FOR SALE.

TWO T.3. Hydraulic Rollover Moulding Machines, manufactured by Foundry Equipment Ltd., for operation on 750 p.s.i., complete with all necessary valves, controls and piping on the machines, and also complete with undersand frame equipment suitable for moulding boxes approximately 26 in. × 24 in. inside dimensions.

WALKER & PARTNERS, LTD.,
23, Claremont Crescent, Sheffield, 10.
'Phone 60983.

BRAYSHAW Gas Fired Bale Out Melting Furnace. Capacity 400 lbs. Working temperature 1,000 deg. C. Complete with all gas and air connections, control valves, etc., etc., and "Foster" temperature indicator and regulator. Condition second-hand, unused. WHITEFIELD MACHINERY & PLANT, LIMITED, 48, Chatham Street, Stockport, Cheshire. Telephone number: Stockport 4471.

TWW

AIR COMPRESSORS

C.f.m.	*Make.*	*lb. p.s.i.*	*Type.*	*H.p.*
300	Broomwade	100	EH.241	75
270	Broomwade	100	EH.240	55
210	C.P.T.	100	PB-4-210	50
200	Belliss & Morcom	100	—	49
200	Broomwade	100	D.23	45
100	Reavell	100	DSA6E	25

THOS W. WARD LTD.
ALBION WORKS : SHEFFIELD
'Phone: 26311 'Grams: "Forward"

Remember · Wards might have it!

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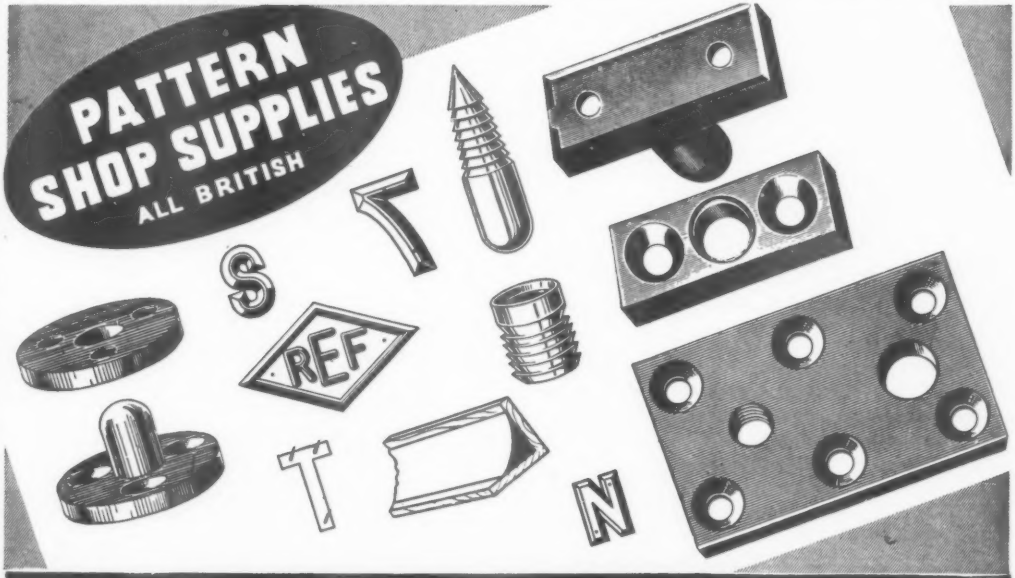

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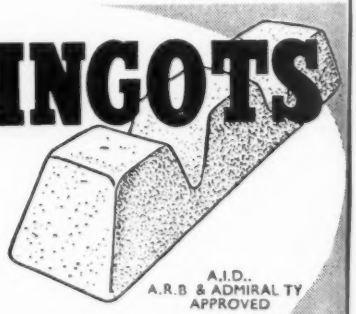

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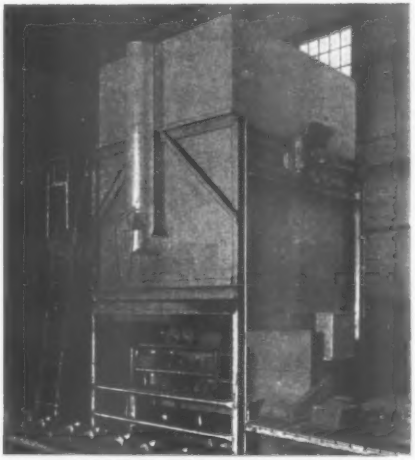

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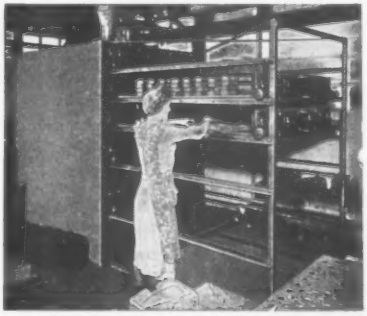

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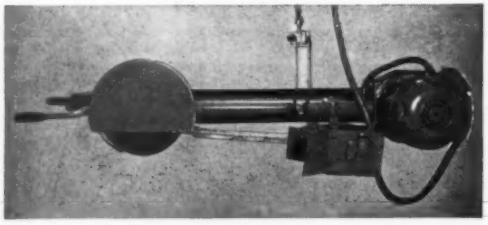

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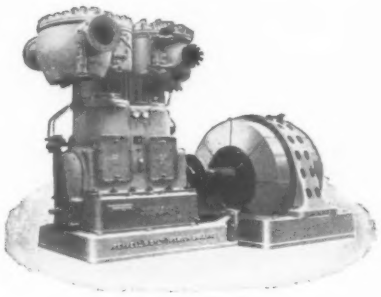

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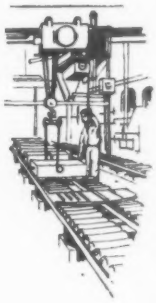

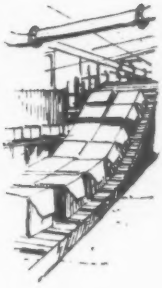

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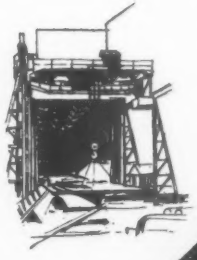

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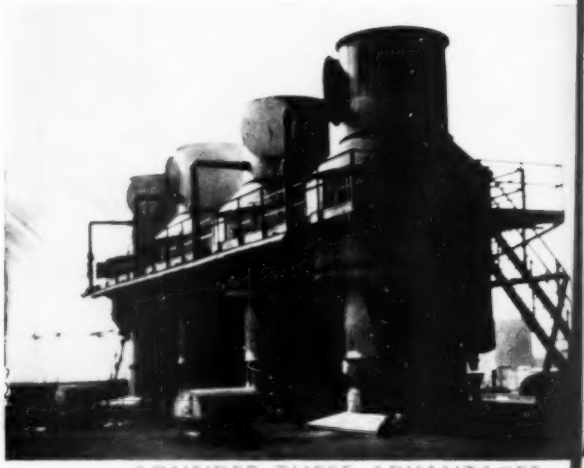

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